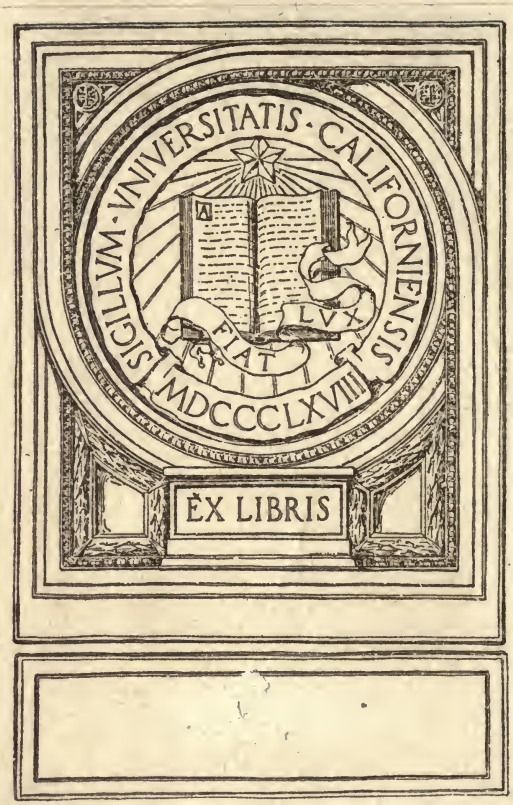
Plumbing Estimates and Contracts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PLUMBING ESTIMATES AND CONTRACTS

By

J. J. COSGROVE

Author of

"PRINCIPLES AND PRACTICE OF PLUMBING"
"SEWAGE PURIFICATION AND DISPOSAL"
"HISTORY OF SANITATION"
"WROUGHT PIPE DRAINAGE SYSTEMS"
"PLUMBING PLANS AND SPECIFICATIONS"
"DESIGN OF TURKISH BATHS"

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Standard Sanitary Mfg. Co.

Pittsburgh, U. S. A.

PREFACE

IN PRESENTING this volume to the public the author completes a set of books devoted exclusively to plumbing which covers the calling from practice to contracting. The several books included in the set are: "Principles and Practice of Plumbing," "Wrought Pipe Drainage Systems," "Sewage Purification and Disposal," Plumbing Plans and Specifications," "Plumbing Estimates and Contracts" and "History of Sanitation.

These books are not disjointed fragments turned out from time to time, without reference to one another, but all are parts of one comprehensive whole, the result of a systematic division of subjects planned before any of the books were written. The object was to present to one volume the principles that underlie the practice of plumbing, and how those principles are applied to practice. In another, a thorough explanation of the wrought pipe systems of drainage together with an exhaustive description of how to handle and manipulate iron, brass and nickel-plated pipe. A third volume was to explain the art of preparing plumbing plans and writing specifications, and a fourth the principles of estimating, contracting and conducting a business.

Closely related to plumbing is Sewage Disposal and General Sanitation, so a fifth volume was devoted to the Purification of Sewage, then, that the plumber might have a proper and profound respect for his calling, a history of sanitation was written to show the antiquity of the craft, its struggles, its failures and its triumphs.

These books, the author believes cover very fully the various subjects, and contain such technical data as has long been needed by those interested in Plumbing and Sanitation.

J. J. COSGROVE

Philadelphia, Pa.,
June 15, 1910.

PUBLISHER'S NOTE

IN THE publisher's note, printed in the various books which preceded this one, we endeavored to make clear our connection with the publication of technical works on plumbing and sanitation, and for the benefit of the readers of this volume, we herewith repeat the story of our relation as Publisher's and Manufacturer's.

The primary object of our organization is, as universally known, to manufacture and market "Standard" Plumbing Fixtures, Brass Goods, and other products made in our factories. In the development of an organization to accomplish this result, there has been established an Advertising and Publishing Department of no small proportions, and "Plumbing Estimates and Contracts" is a part of the work of this department.

One of the most widely known productions of the Publishing Department is the monthly magazine, "Modern Sanitation," which was established in June, 1904. From this came the publication, first in serial form and later as books, of "Principles and Practice of Plumbing," "Sewage Purification and Disposal," "History of Sanitation," "Wrought Pipe Drainage Systems," "Plumbing Plans and Specifications" and "Plumbing Estimates and Contracts." These books are all the work of the same author, Mr. J. J. Cosgrove, who is recognized as one of the leading authorities on the questions upon which he writes.

Mr. Cosgrove's first work was "Principles and Practice of Plumbing." This book has been phenomenally successful and has been adopted as a text book in more than 30 of the largest universities and colleges in the United States.

Several of his other works are similarly used either in the form of text books or as books which students in plumbing and architecture are advised to read.

In "Principles and Practice of Plumbing," Sewage Purification and Disposal," "History of Sanitation," "Wrought Pipe Drainage Systems," "Plumbing Plans and Specifications" and "Plumbing Estimates and Contracts," we feel that the literature of the craft has been enriched in an enduring manner and that we have fully justified our appearance in the field of publishers as amply as we have our standing as manufacturers of a world wide known and used product.

Standard Sanitary Mfg. Co.
Pittsburgh, U. S. A.

Publishing Department.

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ESTIMATES

CHAPTER I

ESTIMATING FROM COMPLETE PLANS AND SPECIFICATIONS

TAKING OFF QUANTITIES

SCOPE of an Estimate.—To intelligently and successfully estimate the cost of plumbing work requires more than a mere knowledge of the construction of buildings, the ability to read plans and the skill to take off quantities from the drawings submitted. The real estimator's work does not stop when he has made up a list of materials which the plans show will be required to complete the work, but he supplements his efforts by determining the best means of assembling the goods, how to ship them, and where and in what condition to buy the goods at the least cost for the quality specified. There is a world of originality and ingenuity required to do this successfully, and, perhaps, this cannot be

better explained than by giving a concrete example of business enterprise which, if in the newspaper world, would be known as a "scoop" or "beat." In common with a number of others, the writer at one time estimated on a large Government building in which there were miles upon miles of extra-strong galvanized wrought pipe to be used. At the time of estimating, the price of pipe had just gone up and the market was in an unsettled condition, threatening every minute to go higher. As prices then stood, within a month black iron pipe had advanced about 40 per cent. and the list on galvanized-iron pipe had gone up even more. The list price on galvanized-iron pipe had been made just double that of plain iron pipe, and with equal discounts galvanized-iron pipe was just twice as costly as plain iron pipe, notwithstanding that the cost of galvanizing was but a fraction of the cost of the pipe.

That was the state of affairs when the bids were opened and the work awarded to the lowest bidder, who was some thousands of dollars below the field, and whose bid was less than the estimated cost of the work as calculated by the other competitors. Loss was freely predicted for the successful contractor by his unsuccessful rivals, who were surprised to see him complete the work with apparent profit. Then the secret of his success leaked out. Instead of figuring the cost of his pipe on the basis of the manufacturers' prices he bought the plain iron pipe from the supply houses, made arrangements with a large galvanizing concern to galvanize all the pipe required for the contract at a price which made the cost of extra-strong galvanized iron pipe but a few cents more per foot than the cost of the plain iron pipe. It is

just such enterprise and originality which make a success of the plumbing business. To all appearances competitors estimate on exactly the same materials, taking their items and quantities from identical plans and specifications; yet, when all is said and done, there is always some chance for the resourceful estimator to profit by his superior knowledge and training, to fairly and honestly beat his competitors. That is what he must do in a large percentage of his endeavors to succeed, and to succeed is what he is in business for. It is the volume of profitable business done in a year which counts, and, as prices to all of equal credit are practically the same, the best chance for the success of a contractor lies in his ability to so plan his work, assemble his materials and handle his contracts generally, that his net cost will be less than that of other contractors.

The foregoing story is told to emphasize the point that to be a successful estimator and contractor requires more than the clerical ability to take off quantities from a plan. To be really successful the estimator must possess a complete knowledge of materials, be perfectly familiar with prices, know how to lay out work in the most economical yet, at the same time, sanitary way; he must know his locality and be perfectly familiar with the best and cheapest means of shipping; he must be accurate, resourceful and capable of judging what constitutes a fair day's work. In addition he should be industrious, have character, tact, courage, confidence in himself and his work, perseverance, good manners and be well dressed. Last, but most important of all, he must be honest. Dishonest methods and principles might

gain a temporary advantage, but a successful career as an estimator and contractor can be founded only on the rock of honesty.

It is not often that the opportunity for a "scoop," like that related of the galvanized-iron pipe, presents itself to the estimator, but a plumbing installation is never estimated on where there is not an opportunity for the display of some originality in design or execution. Indeed, it generally is the estimator who is the most successful in this respect that reaps the reward of his efforts, and it will be the object of the succeeding paragraphs to point out some of the advanced principles of estimating, so that the beginners will know how to approach the task and be on a more equal footing with his more experienced competitors.

Order of Estimating.—It stands to reason that some system or order must be observed in taking off quantities, if confusion is to be avoided and every item entering into the makeup of the work included. For instance, if the plan of a floor be studied and an effort made to take off at one and the same time the various items of fixtures, water supply pipes, soil pipes, lead roughing and brass work on that floor, confusion will ensue and some of the items will be overlooked. A simple but effective plan to follow is to estimate separately the drainage system, the water supply system, fixtures, labor and general conditions. By such a course of procedure each subdivision of the work can be followed out from beginning to end and not an item overlooked.

Reading of Specifications.—The careful estimator will study out not only the plumbing specifications but will likewise read through the general conditions of the general specifications to see if there is anything there which affects the plumbing work. He will look in the mason's specifications, also, to see if the digging of trenches and other excavating called for in his specifications is likewise specified to be done by the mason. In many specifications this conflicting condition is required and the wide-awake estimator who discovers it can take advantage of the conflicting requirement and estimate accordingly. To do so, however, he must first ascertain from the architect which of the contractors, the mason or the plumber, will be required to do the work, for the mason contractor might have had a decision from the architect to the effect that the plumbing contractor will do his own excavating, in which case omitting that item from the estimate would entail loss on the plumbing contractor. Even if the architect should decide that all excavating work for the plumber shall be done by the mason, care must be exercised by the plumbing estimator. If the plumbing specifications are corrected by the architect upon making that decision, all is well; but if no indication or correction is made in the specifications, to protect his own interests the plumbing contractor will either have to estimate on doing the excavating and trust to luck to get out of it, or he can omit the item from his estimate, and, in submitting his bid, state explicitly that it does not include excavating, calling attention at the same time to the provision in the mason's specifications.

In like manner the estimator should examine the carpenter's specifications to see if that contractor is to do his cutting of walls, floors and beams; and the steamfitter's specifications to see if there is a conflicting statement regarding the water-heating apparatus or other parts of the plumbing work. In the case of cutting of walls, floors and beams, this is assumed to be the plumber's work, if nothing is said to the contrary, for the plumbing work cannot be installed without the necessary cutting and patching. Plumbers usually make such a botch of the cutting and repairing work, however, that many architects prefer to have it done by the carpenters. In such cases, the work is specified to be done by the carpenters, and, as it is only implied in the plumbing specifications, but not stated, the requirement in the carpenter's specifications makes it part of his contract. That being so no mention of the cutting and patching need be made in the plumber's tender, while the advantage he gains by reading the carpenter's specifications and learning that work he would otherwise figure on is to be done by another, gives him a slight advantage over his competitors, and the sum of all the slight advantages should secure him the contract.

Accuracy of Estimates.—Accuracy is of prime importance in the making of an estimate, for it would profit a man nothing to be awarded all the work he figures on, only to find that he has lost money on every contract. Conversely, as an estimator's time is of value, it is a waste of money to estimate daily on work only to lose on account of inaccuracies either in the taking off of items or in calculating the cost

of materials. Where plans and specifications are full and complete, and nothing is ambiguous or left to conjecture, the net cost for doing the work should vary but very little among the different contractors estimating on an operation. If they are all equally careful in taking off quantities their several items ought to tally so far as amounts are concerned, and whatever difference there would be in the cost of the various items would arise from the different prices paid for the goods, according as one is a good or bad buyer. The only chance for difference of opinion as to cost will lie in the enterprise and originality or lack of enterprise or originality of the several estimators, and in the computation of the cost of labor. Here again the difference will rise according to the ability of the contractor to select good men and use them advantageously.

On work which is estimated upon, but lost, no record can be kept to show how accurate was the list of materials and the prices allowed. On work contracted for, however, a careful record should be kept, showing the actual cost and the estimated cost of the various items. This information is invaluable to a careful business man. Profit, but only a fair profit, should be made on every item entering into a plumbing contract, and if a loss is experienced instead of a profit the contractor wants to know of the loss and the cause, so he can adopt measures to prevent a repetition. For instance, if the record shows that the quantity of soil pipe estimated on was correct but the pipe cost more than allowed for, that would indicate that something was wrong, with his prices. Investigation might show that the latest quotation, or dis-

count, had not been entered in the cost book, and that consequently he was selling soil pipe at an old price and buying it at a later and higher one. Such information would not be available if it were not for keeping record of all items and checking them up. At all events, the cause of the loss would be ascertained, and the cause eliminated. If, instead of the materials, the items of labor should show a loss it should lead to an investigation of the cause and a revision of the manner of estimating the cost of labor. If an inspection of the personnel of his workmen shows that some are below the average in skill or speed, the remedy obviously would be to replace them with good workmen who could do an average day's labor. If, however, the workmen are up to the average and are doing a fair day's work it would be necessary when estimating on future work to allow less for an actual day's labor.

No less necessary is it to check up and analyze the cause of excess profit on the various items. Each item of actual cost ought to correspond approximately to the estimated cost, and when there is a large balance in favor of the contractor, if he be a careful business man, he will want to know the reason why. If in many of his items the actual cost runs much below the estimated cost he may assume that having the contract awarded to him was more the result of an accident than due to careful business methods and accurate estimating. An estimator should feel as deeply humiliated to have his estimates constantly run above the actual cost as to have them run below, for in either case the discrepancy is due to carelessness, or to ignorance of conditions with which he

should be familiar The careful estimator will try to ascertain the exact amount the labor and material will cost him, then, knowing what percentage he wishes to make on that work, he can easily add the profit. If, after carefully estimating the work, he is underbid and his competitor makes a profit on the contract he knows something is wrong with his prices. He is paying too much for material; his labor is running too high; he has not laid out the work in the building in the most economical way to economize labor and material, or some other condition is against him and that condition must be discovered and overcome before he can succeed.

Scaling Drawings.—Plans for a building cannot conveniently be made of the full size of the building, so they are made much smaller but drawn to scale, so that the proportions on the drawings all bear the same relation to one another that the same portions will on the completed building. The general drawings consisting of floor plans and elevations are generally drawn to a scale of $\frac{1}{4}$-inch to 1 foot, and the details made to a scale of $\frac{3}{4}$-inch to 1 foot. Sometimes the general plans are drawn to the smaller scale of $\frac{1}{8}$-inch to the foot. By $\frac{1}{4}$-inch to the foot is meant that $\frac{1}{4}$-inch in length on the plan will equal 1 foot on the building, and that, consequently, a pipe 3 inches long on the plans, when drawn to a scale of $\frac{1}{4}$-inch per foot, will be 12 feet long in the building. If on the other hand the scale were $\frac{1}{8}$-inch to the foot 3 inches on the drawing would be equal to 24 feet in the building. The scale to which drawings are made is always marked on the plans, and having this scale

furnished, an estimator possesses the key for determining the amount of pipe in the building.

The process of measuring materials on plans is known as the process of "scaling." The manner of scaling pipe by means of a 2-foot rule is shown at (*a*) in Fig. 1.

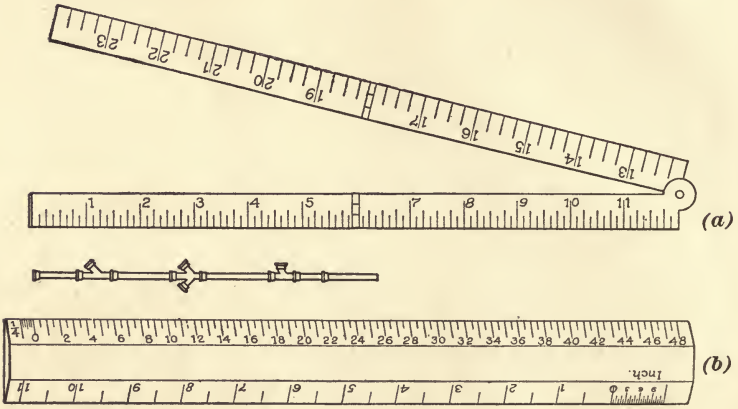

Fig. 1

In the example, assume that the scale is $\frac{1}{4}$-inch to the foot, and it is desired to know the length of pipe shown in the illustration. By measuring, it will be found that the length of the pipe over all is just $6\frac{1}{2}$ inches. As each $\frac{1}{4}$-inch on the plan equals 1 foot of pipe, and there are $6\frac{1}{2} \times 4 = 26$ quarters, or $6\frac{1}{2}$ inches, of pipe on the plan, there must be 26 feet of pipe required for this installation.

As was just shown, an ordinary 2-foot rule can be used for scaling plans, but when a great amount of scaling is to be done, much better time can be made, without the like liability to error, by using a regular

scaling rule. One type of a scaling rule is shown at (*b*) in Fig. 1 It will be noticed that the $\frac{1}{4}$-inch marks are numbered consecutively, so that by reading the number opposite any mark will give in feet the length of pipe scaled. For example, opposite the end of the pipe is the quarter mark, numbered 26, which indicates that the section of the pipe measured is 26 feet long.

A very convenient rule for scaling is made triangular in shape and has $\frac{3}{32}$, $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{2}$, 2 and 3 inch scales marked on its various sides, which enable it to be conveniently used when taking off quantities from plans having any of the foregoing scales per foot.

Plumbing details are usually drawn to a different scale than the plans and elevations. In the details the intention is to show more clearly than can be indicated on the plans just how certain portions of the work are to be done. In order that the drawings will be large enough to show all necessary detail, they are generally made to scales of from $\frac{1}{2}$ inch per foot to 1 inch per foot or even larger if occasion requires.

Permits.—In almost every city a fee is exacted for opening a street, tapping a water main and connecting to the street sewer, consequently, these items of expense must be taken into account when making up an estimate. The cost of a tap is the same in all cases where a simple tap of the regulation size is used; but when there is a deviation from the standard a higher price is charged, and therein is where the danger lies of making a mistake. For instance, if the fee for a $\frac{5}{8}$-inch tap be five dollars, and a multiple connection,

requiring six taps, is called for in the specifications, the total cost for taps would be five multiplied by six = thirty dollars; and the estimator who would figure on a basis of the standard price would lose twenty-five dollars, plus the profit, on that one item. Likewise, the cost would be greater than the regulation price if the street main had to be broken to insert a specified fitting. In such case the estimator should get from the water company an estimate for this part of the work.

The cost of connecting to the sewer is generally the same, regardless of the size of pipe or the quantity of sewage it will convey, so there is little danger of going astray in the cost price of this item. The cost of a permit for opening the street, on the other hand, is generally based on the size of the opening, and is intended to defray the expense of putting the pavement in order after the trench is refilled. On streets which are not paved or macadamized the cost for a permit is nominal, while on paved streets they run quite high. It is of importance in such cases to keep the size of the opening as small as possible, without restricting it to such an extent as to interfere with the economical working of the men; and both water and house sewer should be run in the same trench to save not only the cost of two opening permits but, likewise, the extra cost of digging. It should be remembered by the estimator that the deeper the sewer the wider will have to be the trench, consequently the more costly the paving permit. The estimator, of course, will determine the depth of the main sewer in the street, as without this knowledge he cannot intelligently estimate the cost of excavating.

The location of branch Y's, the depth of sewers in the streets, character of soil in any locality, or any other information relating to the sewers can be had upon application to the city engineer in small cities, or to the Department of Sewers in large cities.

Digging and Refilling Trenches.—The estimator will first ascertain from a comparison of specifications whether the digging of pipe trenches is to be part of the plumbing contract. In case it is, he must next determine the length, depth and materials through which the trench must be cut. The length and depth will give him the breadth, which in turn will give the cubical contents of the earth to be removed. The material to be cut through is important, because the cost per cubic yard of excavating varies with the different materials. If a trench is carried to a depth of over six feet the earth must be handled twice and a scaffold must be built in the trench to hold the earth thrown up while at the same time affording space for the workmen to stand. Further, the trench will have to be made wider to afford room for the men. In loose or sandy soil, wet clay, or any kind of earth which is liable to cave, sheet piling will be necessary to protect the trench from caving in, and to safeguard the workmen. The cost of sheet piling can be ascertained by figuring the length of trench which will require protection at one time then finding the number of two-inch planks of the required length that will cover the surface on both sides and adding four beams the length of the trench. Having the amount of lumber required the cost can be easily ascertained. It is

assumed that the contractor has suitable adjustable trench braces for holding the piling in place. An allowance of time must, of course, be made to cover the labor of setting the sheet piling in place and removing it after the trench is partly filled. When the trench is a long one it may be opened in sections and the sheet piling used over and over again. It is a question which must be decided according to the circumstances of the case whether the lumber for sheet piling is a legitimate item of cost or should be supplied like tools and apparatus. Usually the sheet piling can be removed and used over again. When such is the case and the contractor has plenty of use for the lumber it should be considered as tools or machinery and as belonging to his plant. The only loss is the wear and tear on the lumber which would be allowed for in his general expenses. If, however, the work is to be done at a distance from home where the material would not repay the cost of transportation to the shop, should the use of sheet piling be an exceptional requirement, made necessary by the particular conditions of that one installation, and the lumber be of no further use to the contractor in his business; or if once the sheet-piling is in place it cannot be economically removed then the lumber should be entered on the estimating blank as a legitimate item of cost.

The soils differ so in different localities that the cost of digging trenches in one locality cannot be accepted as a base for estimating the cost of trenching through a different kind of soil in another locality. The contractor must familiarize himself with the substrata in his city and post himself as to the cost per

lineal foot for digging trenches of various depths in the different soils. The presence of water in soil will complicate matters to such an extent that less earth can be thrown out of a trench per day by a man, and, in addition, pumps must be employed for keeping the trench dry. The cost of pumping will depend greatly on the amount of ground-water seeping into the trench. If but slight, a couple of hours per day for one man might suffice, while with an extremely wet ditch a man may be required steadily at the pump. In very long trenches, such as street sewer work, power pumps may be required, All of these various phases of excavating must be considered in connection with each operation, and the cost carefully worked out from the data at hand. However, until such data is available, the information contained in Table I will serve as a guide, and at all times as a check on the cost of handling water in trenches. Table I was compiled by Mr. Eliot C. Clarke, C. E. in 1885 for use during surveys made for the Massachusetts Drainage Commission.

TABLE I

COST OF HANDLING WATER PER 100 LINEAR FEET OF TRENCH

	5 feet Deep	10 feet Deep	15 feet Deep	20 feet Deep	25 feet Deep
SLIGHTLY WET—Hand-pump...	$6.00	$7.00	$9.50	$12.00	$18.00
QUITE WET—One steam-pump; one line 8-inch pipe at 20c. per foot; wells every 500 feet; moving engine, etc., every 500 feet; rent of pump and engine, $3 per day; one engineer, $2.50 per day, fuel.	71.50	73.50	76.50	103.45	127.45
VERY WET—Two steam pumps 12-inch pipe at 36c. per foot, wells every 250 feet, two engines, three engineers, fuel.....	117.00	119.00	126.00	164.00	226.00

The removal of rock, particularly when the plumbing contractor is inexperienced in blasting, had better be sublet to a quarryman. This will prove less expensive to the plumber in the long run, besides relieving him of the responsibility. Until such time as the beginner can learn the exact cost of rock excavation for trenches in his locality, he can figure that it will not be less than $3.50 per cubic yard, and not over $5.50 per yard, provided the quantity to be removed is over ten cubic yards.

Estimating Cost of Earthenware Sewer.—To find the cost of earthenware sewers, scale the plans to find the number of lineal feet of pipe that will be required. To this amount add a certain percentage to allow for defective pipes and lengths which are broken in transit. Ordinarily, when the pipes have been carefully packed and are intelligently handled in getting them from the car to the trench where they are to be used, there is but little broken pipe. In proportion, however, as the pipe has been roughly handled, and the inspector strict, the allowance for breakage must be increased. As an average an allowance for breakage of 6 per cent. will be found sufficient for this purpose. To the cost of the pipe and the allowance for breakage must be added the cost of freight and drayage to the premises. The cost of freight and drayage can be figured from the weights of sewer pipes given in Tables II and III. Next will come the cost of cement; oakum must also be included. In Table IV can be found the length of sewer pipe of different sizes and the number of feet that can be laid with one barrel of Portland cement and one bar-

TABLE II

WEIGHTS AND DIMENSIONS OF STANDARD SEWER PIPE

Size of Pipe	Depth of Sockets In Inches	Thickness In Inches	Annular Space In Inches	Approximate Weight Per Foot	Approximate Feet Per Car Load	Area in Inches
2″	1¾	⅝	¼	6	6.000	3.14
3″	1¾	⅝	¼	8	3,500	7.07
4″	1¾	⅝	¼	9	2,500	12.57
5″	1¾	⅝	⅜	13	2,000	19.63
6″	2	¾	⅜	16	1,600	28.27
8″	2½	13–16	⅜	23	1,000	50.27
9″	2½	⅞	⅜	28	800	63.72
10″	2½	15–16	⅜	34	700	78.54
12″	3	15–16	½	38	550	113.09
15″	3	1⅛	½	63	420	176.71
18″	3	1¼	½	84	380	254.46
20″	3	1⅜	½	99	320	314.16
24″	3	1½	⅝	129	200	452.39
27″	4	1⅝	⅝	146	120	572.55
30″	5	1¾	⅝	161	100	706.85

TABLE III

WEIGHTS AND DIMENSIONS OF DOUBLE STRENGTH SEWER PIPE

Size of Pipe	Depth of Sockets In Inches	Thickness In Inches	Annular Space In Inches	Approximate Weight Per Foot	Approximate Feet Per Car Load	Area in Inches
12″	3	1	½	46	540	113.09
15″	3	1¼	½	65	385	176.71
18″	3	1½	½	95	260	254.46
20″	3	1 11–16	½	123	200	314.16
24″	3	2	⅝	175	140	452.39
27″	4	2⅛	⅝	236	110	572.55
30″	5	2¼	⅝	250	100	706.85

rel of sand. To find the amount of oakum required allow one ounce of oakum at each joint for each inch in diameter of the pipe.

Having the quantities of materials required all that remains is to find the cost of the labor. Some contractors have handy laborers who, at a cost of two dollars per day, can lay tile pipe as well as a mason. Such a saving will go a long way, where much earthenware pipe is to be laid, toward keeping the cost of an estimate down to the winning figure.

TABLE IV

CEMENT AND SAND REQUIRED FOR EARTHENWARE PIPE

Size of pipe in inches	4	5	6	8	10	12	15	18	20	24
Length of pipe in feet	1.200	1,000	800	675	450	300	190	130	100	70
Barrels of cement	1	1	1	1	1	1	1	1	1	1
Barrels of sand	1	1	1	1	1	1	1	1	1	1

The amount of pipe a man can lay per day is the one unknown quantity of the cost of laying the earthenware pipe. The amount, of course, will depend on the size of the pipe, and will likewise be affected by the manner it is to be laid. If the pipe must have a firm bearing along each length on undisturbed earth, with cavities scooped out where the hubs come, the cost of getting the pipe to grade will be greater than if the same pipes are laid on top of boards which are laid with the proper fall. All these things must be taken into account when estimating the amount of pipe which can be laid. For instance, a good man can lay 100 feet of 4 or 5-inch earthenware pipe if the drain is run on boards, bedded on earth at the bottom of the trench, while 50 feet would be a good day's work

when each length of pipe must be separately bedded along its entire length on undisturbed earth.

Estimating Cost of Cast-Iron Soil Pipe.—In scaling the cast-iron soil pipe shown on plans, no deduction is made for fittings unless the fittings are massed together in such a bunch that little or no pipe will be used, in which case the careful estimator will determine just how much pipe he will need after deducting the fittings. The reason for counting the fittings as so much pipe is to compensate for the pipe which is cut to waste, proves defective or is broken in cutting or calking. If the estimator scaled his pipe down to the utmost limit he would be sure to run short on the installation.

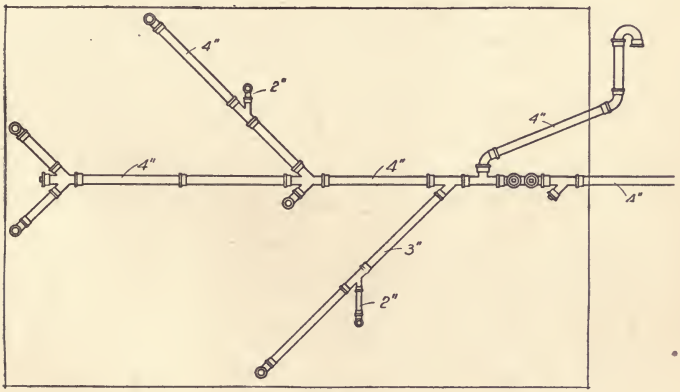

Fig. 2

In order to illustrate the manner of taking off quantities from a cast-iron pipe drainage system the drawing, Fig. 2, is incorporated. In determining the amount of pipe used in the horizontal piping shown

in the plan a rule would be laid on the main run, from the end of the house drain where it will join the house sewer outside the building, and the distance measured to the end of the clean-out screw at the opposite end. This drawing has been reduced so that it is not now drawn to scale, although the plan was originally. But assuming that the extreme length on the original plan was 10 inches, then, as the plan was drawn to a scale of $\frac{1}{4}$-inch to the foot, there would be 40 feet of pipe in this run.

Having the main drain, the branches may be scaled in the same way and the various lengths of the several sizes of pipe jotted down. Having the amount of pipe that will be required the next step is to count and classify the fittings. The first fitting on the line is a 4 x 4 Y branch. This is put down as a 4-inch Y The next fitting is a 4-inch running trap with two vent hubs; next comes a 4-inch T branch, then a 4 x 3 branch, which is listed as a 4-inch Y.

The reason that the 4 x 4 Y, the 4 x 3 Y, also the 4 x 2 Y, are all classed as 4-inch Y fittings is because the list price and discount on branch fittings are the same for straight fittings as for those with reducing branches, and, as the object at this time is only to ascertain the cost, not to order the fittings for the work, the various branch fittings are jotted down as though of uniform size at all the outlets.

Assuming that the pipe as scaled shows 85 feet of 4-inch pipe, 22 feet of 3-inch pipe and 7 feet of 2-inch pipe; and that the pipe is to be of extra heavy quality, tar coated both inside and outside, then the list of items so far as we have gone would contain the following materials and quantities:

LIST OF MATERIALS

Quantity	Material
85 feet	4-inch extra heavy tar-coated soil pipe
22 feet	3-inch extra heavy tar-coated soil pipe
7 feet	2-inch extra heavy tar-coated soil pipe
2	4-inch double Y's
3	4-inch Y's
1	4-inch running trap, two top openings
1	4-inch T
4	4-inch long-turn ¼ bends
1	4-inch return bend
2	4-inch ⅛ bends
4	4-inch iron body screw cleanouts
1	3-inch Y
1	3-inch long-turn ¼ bend
2	2-inch long-turn ¼ bends

It will be noticed that only the sizes and lengths of pipes and the sizes and kinds of fittings can be had from the plans and the quality, such as extra heavy tar coated, and the description of the cleanout screws must be obtained from the specifications.

Having the length of pipe and the number of fittings the next requirement is to find the amount of lead and oakum that will be required. To learn this the number of joints of different size must be counted. The plan shows that there are thirty-one 4-inch joints, five 3-inch joints and five 2-inch joints, and the lead and oakum required for these joints can be found by means of the following rules:

Rule I.—To find the quantity of lead required to calk a joint in iron pipe, allow one pound of lead for each inch in diameter of the pipe.

Example.—What weight of lead will be required to calk twenty 6-inch pipe joints?

Solution—According to the rule, 6 pounds of lead will be required for one 6-inch pipe joint, conse-

quently, 20 joints will require 20 x 6 = 120 pounds of lead.

In like manner the amount of oakum can be found by the following rule:

Rule.—To find the oakum required to pack soil-pipe joints allow two ounces of oakum for each inch in the diameter of the pipe.

Example.—What weight of oakum will be required to pack twenty 6-inch pipe joints?

Solution.—According to the rule, 12 ounces of oakum will be required for one 6-inch pipe joint, therefore 12 x 20 = 220 ounces, or 15 pounds, of oakum will be required for twenty 6-inch joints.

Applying the two foregoing rules to the example of estimating under consideration, we find that it will require 149 pounds of lead and about 18 pounds of oakum for making the joints.

The labor of installing the pipe is the only item which cannot be definitely determined. This is so much a matter of the personal ability of the journeyman plumber that no definite length of time can be stated which would not be too short for some workmen and much longer than would be required by others. Assuming, however, that the trenching is done, the points of the various rising lines all marked so that the plumber has nothing to do but proceed with the installation of the pipes a good swift workman and his helper would install the pipe shown in the illustration in two days. That would be too short an allowance to make, however, as the average workman could not do it in less than three days. The estimator must know his men and be familiar with their capabilities and limitations. The personnel of the work-

men in different shops varies to such an extent that the workmen of some shops require on an average 50 per cent. more time to do a given amount of work than would be required by the workmen of other shops.

The work shown in the illustration is supposed to be run in shallow trenches under the level of the cellar floor. If run in deep trenches an extra allowance of at least 10 per cent. should be made to offset the extra work and difficulties encountered. If on the other hand, the work is to be suspended under the ceiling beams, an extra allowance of 50 per cent. should be made.

The cost of labor having been determined, nothing remains to calculate but the cost of fuel for melting the lead. This can be arrived at by the number of days the man is employed on the work. One gallon of gasoline will last about one day, so that if the workman spends three days on the work it would require three gallons of gasoline to supply him. The various items of pipe, fittings, lead, oakum, fuel, labor, having now been ascertained, there remains nothing further to be taken from this plan and the task of taking off quantities may be considered as completed, although by no means has the entire work of making up an estimate been finished, for items of freight, drayage, profit, operating and other expenses which will be explained later must be taken into account, and the costs of the various items ascertained. The weight of standard and extra heavy soil pipe may be found in Table V, and from these weights the freight and drayage charges can be calculated.

TABLE V

SIZES AND WEIGHTS OF CAST-IRON SOIL PIPE

Inside Diameter of Pipe	Average Weights Per Lineal Foot, Including Hubs	
	Standard	Extra Heavy
2 inches	3½ pounds	5½ pounds
3 inches	4½ pounds	9½ pounds
4 inches	6½ pounds	13 pounds
5 inches	8½ pounds	17 pounds
6 inches	10½ pounds	20 pounds
7 inches	13 pounds	27 pounds
8 inches	18 pounds	33½ pounds
10 inches	25 pounds	44 pounds
12 inches	30 pounds	54 pounds
15 inches	45 pounds	.....

Estimating Cost of Wrought Pipe.—In taking off the quantity of wrought pipe for an operation the plans are scaled, as in the case of cast-iron pipe, and the fittings are counted. All of the branch fittings that will be required can be determined from the drawings, if complete, but an allowance of 45° elbows must be made for offsetting around obstructions which might not be shown on the drawings, and to offset at various heights of the building where the walls are made thinner. This latter allowance is necessary only when the stacks are run against outside walls, from which they are to be spaced a uniform distance.

The number of extra fittings required for this purpose can be ascertained, with a fair degree of accuracy, by noting the various floors of the building where offsets will have to be made, and locating the various obstructions in the basement around which the horizontal pipes will have to be run.

The manner of taking off quantities from wrought-pipe systems is shown in Fig. 3. In the example

illustrated the fittings occupy so much of the space that the sum of the length of the different pieces of pipe would be found by scaling, and only that amount of pipe listed in the estimate sheet. This is the more necessary, as there is but little waste to wrought pipe and allowance need not be made for waste, as would be the case with cast-iron pipe.

Having the number of feet of pipe, the fittings would next be counted, and if this layout represents the work in a number of toilet rooms the pipe and fittings in the one layout can be multiplied by the number of toilet rooms in the building to ascertain

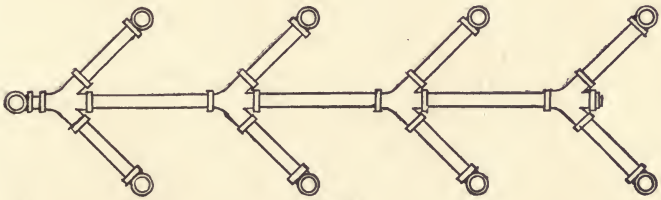

Fig. 3

the total number of fittings and length of pipe required to rough-in all the toilet rooms. The necessity for accuracy in estimating can well be pointed out and emphasized in this example. For instance, there are 4 double Y's, and measuring the length of the fittings, then adding the distance from the center of the fitting to the end of the branches, each Y fitting occupies 2 feet in length. Besides the branch fittings there are 9 elbows, each of which occupies 6 inches along the run. If, therefore, a careless estimator, instead of taking off only the exact amount of pipe required for each toilet room, were to scale over

TABLE VI

MALLEABLE IRON FITTINGS

Classification and List. Adopted June 5, 1907.

Class	A	B	C
Price per lb.. Black	.40	.20	.12
Price per lb., Galv	.50	.28	.19
Elbows	$\frac{1}{8}$ x $\frac{1}{8}$ $\frac{1}{4}$ x $\frac{1}{8}$ $\frac{3}{8}$ x $\frac{1}{8}$	$\frac{1}{4}$ x $\frac{1}{4}$ $\frac{1}{2}$ x $\frac{1}{4}$ $\frac{3}{8}$ x $\frac{3}{8}$ $\frac{1}{2}$ x $\frac{3}{8}$ $\frac{3}{8}$ x $\frac{1}{4}$ $\frac{1}{2}$ x $\frac{3}{8}$	* $\frac{3}{4}$ and larger
Elbows, R and L	$\frac{1}{4}$ and $\frac{3}{8}$	$\frac{1}{2}$, $\frac{3}{4}$ and 1	*1$\frac{1}{4}$ and larger
Elbows, 45°		$\frac{1}{4}$ to 2 inclusive	2$\frac{1}{2}$ and larger
Elbows, Street		$\frac{1}{4}$ to 1 x $\frac{3}{4}$ inclusive	1 and larger
Elbows, Side Outlet		all sizes	
Elbows, Drop		all sizes	
Tees	$\frac{1}{8}$ x $\frac{1}{8}$ $\frac{1}{4}$ x $\frac{1}{8}$ $\frac{1}{8}$ x $\frac{1}{4}$ $\frac{3}{8}$ x $\frac{1}{8}$	$\frac{1}{4}$ x $\frac{1}{4}$ $\frac{3}{8}$ x $\frac{1}{4}$ $\frac{3}{8}$ x $\frac{3}{8}$ $\frac{3}{8}$ x $\frac{1}{4}$ x $\frac{3}{8}$ $\frac{1}{4}$ x $\frac{3}{8}$ $\frac{1}{2}$, and $\frac{1}{2}$ $\frac{3}{8}$ x $\frac{1}{4}$ x $\frac{1}{2}$ reducing	* $\frac{3}{4}$ and larger
Tees, service		$\frac{1}{2}$, $\frac{3}{4}$ and 1 x $\frac{3}{4}$ x 1	1 and larger
Tees, Four Way		all sizes	
Tees, drop		all sizes	
Crosses		$\frac{1}{4}$ to 1 inclusive	1$\frac{1}{4}$ and larger
Crosses, Reducing		1 and smaller	*1$\frac{1}{4}$ and larger
Y Bends		all sizes	
Return Bends	$\frac{1}{4}$	$\frac{3}{8}$ to 1 inclusive	1$\frac{1}{4}$ and larger
Return Bends, R and L	$\frac{3}{8}$ and $\frac{1}{2}$	$\frac{3}{4}$ and larger	
Couplings, R H	$\frac{1}{8}$	$\frac{1}{4}$ to $\frac{3}{4}$ inclusive	1 and larger
Couplings, R and L	$\frac{1}{8}$	$\frac{1}{4}$ to $\frac{3}{4}$ inclusive	1 and larger
Couplings, Reducing	$\frac{1}{4}$ x $\frac{1}{8}$, $\frac{3}{8}$ x $\frac{1}{8}$, $\frac{1}{2}$ x $\frac{1}{8}$	$\frac{3}{8}$ x $\frac{1}{4}$ to 1 x $\frac{3}{4}$ inclusive	*1$\frac{1}{4}$ and larger
Caps	$\frac{1}{8}$	$\frac{1}{4}$ to 1 inclusive	1$\frac{1}{4}$ and larger
Lock Nuts	$\frac{1}{8}$	$\frac{1}{4}$ to 1$\frac{1}{4}$ inclusive	1$\frac{1}{2}$ and larger
Extension Pieces		all sizes	
Waste Nuts		all sizes	
Chandelier Hooks		all sizes	
Chandelier Loops		all sizes	

*Fittings in class C, having one or more outlets smaller than $\frac{3}{4}$, will be charged in class B.
The run of tees gives the size for the purpose of classification, and the outlet being larger does not change it.

TABLE VII

LIST PRICE ON BLACK MALLEABLE FITTINGS

Size.....Inches...	⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
Elbows. Straight and Reducing	.06	.07	.08	.10	.15	.22	.25	.35	.50	.90	1.50	2.25	3.00	3.50	4.00	6.50
Elbows, Right and Left	...	.09	.11	.13	.17	.25	.30	.40	.65							
Elbows, 45°	....	.08	.10	.12	.18	.26	.36	.54	.82	1.25	2.50	3.25	4.50	5.25	6.00	7.50
Elbows, 60°	....	....	....	....	....	.25	.30	.45	.65							
Elbows, Street	....	.10	.10	.12	.20	.25	.40	.55	.90	1.50	2.25		3.50			
Elbows, 45° Street	....	....	....	.12	.20	.25	.40	.55	.90							
Elbows, Side Outlet	....	....	.08	.10	.18	.30	.45	.60	1.00							
Elbows, Drop	....	.06	.08	.12	.20	.25										
Elbows, Long Drop	....	....	.10													
Tees, Straight and Reducing	.07	.08	.09	.11	.15	.25	.30	.45	.60	1.05	1.70	2.50	3.40	4.25	5.00	7.75
Tees, Drop	....	....	.10	.14	.22	.30										
Tees, Long Drop	....	....	.12													
Tees, Service	....	....	.12	.15	.25	.35	.50	.75	1.15	2.00						
Tees, Four Way	....	....	.12	.14	.20	.35	.50	.80	1.25							
Crosses, Straight and Reducing	....	.09	.10	.16	.20	.30	.40	.60	1.00	1.75	3.00	3.25	5.25		7.50	13.00
Caps	....	.03	.04	.05	.08	.12	.16	.24	.32	.45	.85	1.00	1.20		2.50	3.50
Couplings, Right Hand	....	.03	.05	.07	.10	.14	.20	.25	.35							
Couplings, Right and Left	....	.04	.06	.08	.12	.16	.25	.36	.52	.70	1.00					
Couplings, Reducing	....	.05	.06	.07	.10	.16	.20	.28	.45	.70	1.00	1.50	1.85			
Lock Nuts	....	.02	.03	.04	.05	.07	.09	.11	.18							
Waste Nuts	....	.04	.05	.06	.08	.10	.15	.25								
Extension Pieces	....	....	.06	.09	.12	.15										
Chandelier Hooks or Loops	....	....	.10	.12												
Y Branches, Straight and Reducing	....	....	....	.40	.50	.60	.80	1.00	1.70	2.00	4.00		5.50			
Y Branches, 60° Straight and Reducing	....	....	....	....	....	....	....	1.00	1.70							
Return Bends, Close or Medium, R. H	....	....	....	.18	.25	.35	.50	.75	1.00							
Return Bends, Close or Medium, R. & L. or L. H	....	....	....	.23	.30	.45	.60	.90	1.25							
Return Bends, Open Pattern, R. H	....	....	....	.20	.30	.50	.65	.85	1.25	2.00	3.00					
Return Bends, Open Pattern, R. & L. or L . H	....	....	....	.25	.38	.60	.80	1.05	1.55	2.50	3.75					
Crossovers	....	....	....	.20	.30	.45										

DISCOUNT.....% DATE.....190....

all, measuring the fittings as though they were pipes in one layout, such as shown in the illustration, he would figure on using 12½ feet of pipe more than would be required. Then, in a building many stories in height, where there are, say, twenty toilet rooms to be roughed-in, in accordance with the sketch, he would figure on using 20x12½ equals 250 feet of pipe more than his more careful competitors, and this one item of excess cost might lose the contract. If not, there is no doubt but that an estimator so careless as to figure that quantity of pipe more than is required for roughing-in the toilet rooms would be equally careless in taking off other quantities, and either lose the work by being too high or overlook some important item which would win the contract for him to his sorrow.

Knowing the quantity of pipe and fittings, the number and kind of hangers must be ascertained, and the labor measuring, cutting, threading and installing the pipe. This will depend not only on the personnel of the workmen but on the quality of the tools given them to work with. Cutting and threading large pipes is machine work and satisfactory work cannot be economically done with old, wornout, unsuitable hand tools. If the contractor expects good work of average quantity he must supply his workmen with the necessary tools and apparatus. As the matter stands, each estimator must determine for himself just how long it will take his workmen to do the work with the tools and apparatus at their command.

In estimating the cost of fittings for wrought pipe it should be borne in mind that all large size fittings—

TABLE VIII

LIST PRICE ON GALVANIZED MALLEABLE FITTINGS

Size.....Inches	⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6
Elbows, Straight and Reducing	.08	.09	.11	.14	.20	.32	.40	.60	.90	1.50	2.60	3.75	5.00	6.50	10.00
Elbows, Right and Left				.17	.23	.35	.45	.65	1.00						
Elbows, 45°		.12	.15	.20	.25	.40	.50	.85	1.35	1.90	3.75	4.75	6.75	9.00	11.00
Elbows, 60°							.45	.70	1.05						
Elbows, Street		.12	.12	.15	.28	.35	.55	.80	1.30	2.25	3.50				
Elbows, 45° Street				.15	.28	.35	.55	.80	1.30						
Elbows, Side Outlet			.10	.15	.25	.45	.65	.90	1.50						
Elbows, Drop			.12	.20	.35										
Elbows, Long Drop			.18												
Tees, Straight and Reducing	.09	.10	.13	.16	.20	.38	.50	.70	1.00	1.90	3.00	4.25	5.75	8.00	12.00
Tees, Drop			.15	.25	.40	.55									
Tees, Long Drop			.17												
Crosses, Straight and Reducing		.12	.14	.25	.29	.45	.60	.90	1.50	2.75	4.50		8.00		
Caps		.04	.05	.08	.12	.17	.24	.38	.52	.76	1.30	1.60	2.00		
Couplings, Right Hand		.05	.07	.10	.17	.23	.30	.40	.55						
Couplings, Right and Left		.06	.09	.10	.17	.25	.35	.55	.75	1.05	1.50				
Couplings, Reducing		.08	.10	.10	.15	.25	.35	.45	.75	1.05	1.65	2.40	3.05		
Lock Nuts		.03	.04	.05	.07	.10	.14	.20	.30						
Waste Nuts		.08	.10	.12	.16	.20	.30	.50							
Extension Pieces			.09	.13	.18	.22									
Y Branches, Straight and Reducing				.60	.75	.90	1.25	1.50	2.50	3.00	6.00		8.25		
Y Branches, 60° Straight and Reducing								1.50	2.50						
Return Bends, Close or Medium, R. H				.25	.35	.55	.75	1.15	1.65						
Return Bends, Close or Medium, R. & L. or L. H					.40	.65									
Return Bends, Open Pattern, R. H				.28	.45	.70	.90	1.25	2.00	3.50	5.00				
Return Bends, Open Pattern, R. & L. or L. H					.55	.80									
Crossovers				.25	.40	.60									

DISCOUNT.....% DATE.....190....

TABLE IX

DIMENSIONS AND WEIGHTS OF STANDARD WROUGHT PIPE

Diameter			Thickness	Circumference		Transverse Areas			Length of Pipe per sq. foot of		Length of pipe containing 1 cubic foot	Nominal weight per foot	Number of threads per inch of screw
Nominal internal	Actual external	Actual internal		External	Internal	External	Internal	Metal	External surface	Internal surface			
Inches	Inches	Inches	Inches	Inches	Inches	Sq. In.	Sq. In.	Sq. In.	Feet	Feet	Feet	Pounds	
$\frac{1}{8}$	.405	.27	.068	1.272	.848	.129	.0573	.0717	9.44	14.15	2513	.241	27
$\frac{1}{4}$	.54	.364	.088	1.696	1.144	.229	.1041	.1249	7.075	10.49	1383.3	.42	18
$\frac{3}{8}$	.675	.494	.091	2.121	1.552	.358	.1917	.1663	5.657	7.73	751.2	.559	18
$\frac{1}{2}$	.84	.623	.109	2.637	1.957	.554	.3048	.2492	4.547	6.13	472.4	.837	14
$\frac{3}{4}$	1.05	.824	.113	3.299	2.589	.866	.5333	.3327	3.637	4.635	270.	1.115	14
1	1.315	1.048	.134	4.131	3.292	1.358	.8626	.4954	2.904	3.645	166.9	1.668	$11\frac{1}{2}$
$1\frac{1}{4}$	1.66	1.38	.14	5.215	4.335	2.164	1.496	.668	2.301	2.768	96.25	2.244	$11\frac{1}{2}$
$1\frac{1}{2}$	1.9	1.611	.145	5.969	5.061	2.835	2.038	.797	2.01	2.371	70.66	2.678	$11\frac{1}{2}$
2	2.375	2.067	.154	7.461	6.494	4.43	3.356	1.074	1.608	1.848	42.91	3.609	$11\frac{1}{2}$
$2\frac{1}{2}$	2.875	2.468	.204	9.032	7.753	6.492	4.784	1.708	1.328	1.547	30.1	5.739	8
3	3.5	3.067	.217	10.996	9.636	9.621	7.388	2.243	1.091	1.245	19.5	7.536	8
$3\frac{1}{2}$	4.	3.548	.226	12.566	11.146	12.566	9.887	2.679	.955	1.077	14.57	9.001	8
4	4.5	4.026	.237	14.137	12.648	15.904	12.73	3.174	.849	.949	11.31	10.665	8
$4\frac{1}{2}$	5.	4.508	.246	15.708	14.162	19.635	15.961	3.674	.764	.848	9.02	12.49	8
5	5.563	5.045	.259	17.477	15.849	24.306	19.99	4.316	.687	.757	7.2	14.502	8
6	6.625	6.065	.28	20.813	19.054	34.472	28.888	5.584	.577	.63	4.98	18.762	8
7	7.625	7.023	.301	23.955	22.063	45.664	38.738	6.926	.501	.544	3.72	23.271	8
8	8.625	7.982	.322	27.096	25.076	58.426	50.04	8.386	.443	.478	2.88	28.177	8
9	9.625	8.937	.344	30.238	28.076	72.76	62.73	10.03	.397	.427	2.29	33.701	8
10	10.75	10.019	.366	33.772	31.477	90.763	78.839	11.924	.355	.382	1.82	40.065	8
11	11.75	11.	...	36.914	34.558	108.434	95.033	13.401	.325	.347	1.51	45.028	8
12	12.75	12.	...	40.055	37.7	127.677	113.098	14.579	.299	.319	1.27	48.985	8
13	14.	13.25	...	43.982	41.626	153.938	137.887	16.051	.273	.288	1.04	53.921	8
14	15.	14.25	...	47.124	44.768	176.715	159.485	17.23	.255	.268	.903	57.893	8
15	16.	15.43	...	50.26	48.48	201.06	187.04	14.02	.239	.248	.77	62.	8
16	17.	16.4	...	53.41	51.52	226.98	211.24	15.74	.225	.233	.68	...	8
17	18.	17.32	...	56.55	54.41	254.47	235.61	18.86	.212	.221	.61	...	8

TABLE X

DIMENSIONS AND WEIGHTS OF EXTRA STRONG WROUGHT PIPE

Diameter			Thickness	Nearest Wire Gauge	Circumference		Transverse Areas			Length of Pipe per sq. Foot of		Nominal Weight per Foot
Nominal Internal	Actual External	Approximate Internal Diameter			External	Internal	External	Internal	Metal	External Surface	Internal Surface	
Ins.	Inches	Inches	Inches	No.	Inches	Inches	Sq. Ins.	Sq. In.	Sq. In.	Feet	Feet	Lbs.
⅛	.405	.205	.1	12½	1.272	.644	.129	.033	.086	9.433	18.632	.29
¼	.54	.294	.123	11	1.696	.924	.229	.068	.161	7.075	12.986	.54
⅜	.675	.421	.127	10½	2.121	1.323	.358	.139	.219	5.657	9.07	.74
½	.84	.542	.149	9	2.639	1.703	.554	.231	.323	4.547	7.046	1.09
¾	1.05	.736	.157	8½	3.299	2.312	.866	.452	.414	3.637	5.109	1.39
1	1.315	.951	.182	3	4.131	2.988	1.358	.71	.648	2.904	4.016	2.17
1¼	1.66	1.272	.194	6½	5.215	3.996	2.164	1.271	.893	2.301	3.003	3.
1½	1.9	1.494	.203	6	5.969	4.694	2.835	1.753	1.082	2.01	2.556	3.63
2	2.375	1.933	.221	5	7.461	6.073	4.43	2.935	1.495	1.608	1.975	5.02
2½	2.875	2.315	.28	2	9.032	7.273	6.492	4.209	2.283	1.328	1.649	7.67
3	3.5	2.892	.304	1	10.996	9.085	9.621	6.935	3.052	1.091	1.328	10.25
3½	4.	3.358	.321	0	12.566	10.549	12.566	8.856	3.71	.955	1.137	12.47
4	4.5	3.818	.341	0	14.137	11.995	15.904	11.449	4.455	.849	1.	14.97
4½	5.000	4.280	.360	00	15.708	13.446	19.635	14.387	5.248	.764	.748	18.22
5	5.563	4.813	.375	00	17.477	15.120	24.306	18.193	6.12	.687	.793	20.54
6	6.625	5.75	.437	000	20.813	18.064	34.472	25.967	8.505	.577	.664	28.58

Extra strong pipe is always shipped without threads or couplings. unless otherwise specified.

that is, fittings 1½ inches in diameter and larger—are listed and sold at a certain price per fitting. This is likewise true of all cast-iron steam and water fittings of whatever size. Malleable fittings, on the other hand, if under 1½ inches in size are sold by the pound, according to certain classifications. According to the classifications the smaller fittings cost more per pound than the large fittings, but to compensate for that fact there are more fittings to a pound. The size and classification of the various fittings can be seen in Table VI.

The list prices for the various classes of fittings indicated in Table VI are subject to change at any time. They are here given merely to show comparatively the cost per pound of the various classes of malleable fittings.

For quick reference the plumber will find it a great convenience to have at hand a card showing in tabular form either the list or the net prices for each fitting of the various kinds and sizes. If a net price list for black malleable fittings is compiled, while more convenient for reference it will have to be revised from time to time, sometimes as often as once a week, as the discount fluctuates; while if a card or chart made up as shown in Table VII be prepared, giving the list prices, the table will not have to be changed until a new list is adopted by the association of manufacturers, a revision which occurs only once in several years.

Such a table will save untold time figuring the number of the smaller fittings in a pound of the various classes, or the number of pounds in a fitting of the larger sizes. The card can easily be ruled by the bookkeeper on a large bristol-board card, and the prices

TABLE XI

DIMENSIONS AND WEIGHTS OF DOUBLE EXTRA STRONG WROUGHT PIPE

Diameter			Thickness	Nearest Wire Gauge	Circumference		Transverse Areas			Length of Pipe Per Sq. Foot of		Nominal Weight per Foot
Nominal Internal	Actual External	Approximate Internal Diameter			External	Internal	External	Internal	Metal	External Surface	Internal Surface	
Ins.	Inches	Inches	Inches	No.	Inches	Inches	Sq. Ins.	Sq. Ins.	Sq. Ins.	Feet	Feet	Pounds
$\frac{1}{4}$	.84	.244	.298	1	2.639	.766	.554	.047	.507	4.547	15.667	1.7
$\frac{3}{4}$	1.05	.422	.314	1	3.299	1.326	.866	.139	.727	3.637	9.049	2.44
1	1.315	.587	.364	00	4.131	1.844	1.358	.271	1.087	2.904	6.508	3.65
$1\frac{1}{4}$	1.66	.885	.388	00	5.215	2.78	2.164	.615	1.549	2.304	4.317	5.2
$1\frac{1}{2}$	1.9	1.088	.406	000	5.969	3.418	2.835	.93	1.905	2.01	3.511	6.4
2	2.375	1.491	.442	0000	7.461	4.684	4.43	1.744	2.686	1.608	2.561	9.02
$2\frac{1}{2}$	2.875	1.755	.560	$\frac{9}{16}$	9.032	5.513	6.492	2.419	4.073	1.328	2.176	13.68
3	3.5	2.284	.608	$\frac{5}{8}$	10.996	7.175	9.621	4.097	5.524	1.091	1.672	18.56
$3\frac{1}{2}$	4.	2.716	.642	$\frac{5}{8}$ X	12.566	8.533	12.566	5.794	6.772	.955	1.406	22.75
4	4.5	3.136	.682	$\frac{11}{16}$	14.137	9.852	15.904	7.724	8.18	.849	1.217	27.48
$4\frac{1}{2}$	5.000	3.564	.718	$\frac{3}{4}$	15.708	11.197	19.635	9.976	9.659	.764	1.000	32.53
5	5.563	4.063	.75	$\frac{3}{4}$	17.477	12.764	24.306	12.965	11.34	.687	.940	38.12
6	6.625	4.875	.875	$\frac{7}{8}$	20.813	15.315	34.472	18.666	15.806	.577	.784	53.11

Double extra strong pipe is always shipped without threads or couplings unless otherwise specified.

per piece filled in, a place being left at the bottom for the discount and date of last quotation.

In like manner the list price on galvanized malleable fittings is shown in Table VIII. This table may be ruled on a separate sheet of bristol board, or placed on the back side of the price list for black malleable fittings.

In order that the estimator may compute the cost of freight and drayage, he must be able to reduce the number of feet of wrought pipe to pounds. This he can readily do by means of tables IX., X. and XI.

Estimating Cost of Copper or Brass Pipe.—Brass pipe, also copper pipe, is sold by the pound, the

TABLE XII

SEAMLESS DRAWN BRASS AND COPPER TUBES

IRON PIPE SIZES

Same as Iron Pipe Inches	Weight per Foot Approximate		Approx. Outside Diameter Frac. Inches	Exact Outside Diameter Dec. Inches	Exact Inside Diameter Dec. Inches
	Brass	Copper			
$\frac{1}{8}$	.25	.26	$\frac{3}{8}$	.405	.281
$\frac{1}{4}$	.43	.45	$\frac{9}{16}$	.540	.375
$\frac{3}{8}$	.62	.65	$\frac{11}{16}$	.675	.494
$\frac{1}{2}$	.90	.95	$\frac{13}{16}$	.840	.625
$\frac{3}{4}$	1.25	1.31	$1\frac{1}{16}$	1.050	.822
1	1.70	1.79	$1\frac{5}{16}$	1.315	1.062
$1\frac{1}{4}$	2.50	2.63	$1\frac{5}{8}$	1.660	1.368
$1\frac{1}{2}$	3.00	3.15	$1\frac{7}{8}$	1.900	1.600
2	4.00	4.20	$2\frac{3}{8}$	2.375	2.062
$2\frac{1}{2}$	5.75	6.04	$2\frac{7}{8}$	2.875	2.500
3	8.30	8.72	$3\frac{1}{2}$	3.500	3.062
$3\frac{1}{2}$	10.90	11.45	4	4.000	3.500
4	12.70	13.34	$4\frac{1}{2}$	4.500	4.000
$4\frac{1}{2}$	13.90	14.60	5	5.000	4.500
5	15.75	16.54	$5\frac{9}{16}$	5.563	5.062
6	18.30	19.22	$6\frac{5}{8}$	6.625	6.125
7	25.30	26.57	$7\frac{5}{8}$	7.625	7.062

Stock Lengths, 12 feet

price depending upon the quality and size of the pipe and whether it is plain or polished. Fittings are sold by the piece, not by the pound, so that in taking off quantities the pipe would be scaled and the fittings counted the same as for wrought pipe. There is this difference in the case of brass and copper pipe, however—when the number of feet of the various sizes

TABLE XIII

SEAMLESS DRAWN BRASS AND COPPER TUBES

EXTRA HEAVY IRON PIPE SIZES

Same as Iron Pipe Inches	Weight per Foot Approximate		Exact Outside Diameter Dec. Inches	Exact Inside Diameter Dec. Inches
	Brass	Copper		
⅛	.370	.388	.405	.205
¼	.625	.650	.540	.294
⅜	.830	.870	.675	.421
½	1.200	1.260	.840	.542
¾	1.660	1.750	1.050	.736
1	2.360	2.478	1.315	.951
1¼	3.300	3.465	1.660	1.272
1½	4.250	4.462	1.900	1.494
2	5.460	5.733	2.375	1.933
2½	8.300	8.715	2.875	2.315
3	11.200	11.760	3.500	2.892
3½	13.700	14.385	4.000	3.358
4	16.500	17.325	4.500	3.818

NOTE—When "Extra Heavy Iron Pipe Size" is ordered this list is followed unless order specifies a certain per cent heavy.

of brass and copper pipe have been ascertained they should be multiplied, respectively by their weights per lineal foot, to reduce the quantities to pounds.

The weights per foot vary with the quality of pipe specified, which should be stated in the specifications. If not stated the weights can be found in catalogues of plumbing goods. To those who are

skilled in working brass or copper pipe it takes no longer to install a piece of work than if the work were to be done with iron pipe. In fact, if anything it is easier and quicker to work brass or copper pipe than it is to work iron pipe. The weights per foot corresponding to the various sizes of brass and copper pipe can be found in Tables XII, XIII and XIV.

TABLE XIV

BRASS PLUMBING TUBES

STANDARD SIZES

Size	Stubs Gauge	Approximate Weight per Foot	Exact Outside Diameter Dec. Inches	Exact Inside Diameter Dec. Inches
$\frac{5}{8}$	15	.46	.654	.521
$\frac{3}{4}$	15	.56	.768	.631
$\frac{7}{8}$	15	.67	.875	.728
1	14	.88	1.000	.836
$1\frac{1}{4}$	13	1.27	1.245	1.060
$1\frac{1}{2}$	13	1.55	1.508	1.311
$1\frac{3}{4}$	13	1.82	1.756	1.564
2	13	2.10	2.007	1.815

Estimating Lead Roughing.—The lead roughing for a toilet room is estimated by taking off all the quantities, such as lead pipe, bends, traps, ferrules, solder nipples and solder required for the work. To this, of course, would be added the cost of labor, operating expenses, profit, etc., but these would be made up separately and not confused with the items of materials. For instance, in taking off quantities, instead of allowing so much for that work and adding at the same time the percentage for operating expenses and profit, the materials alone are taken off first, then the labor for the entire installation is calculated when there is nothing else to keep in mind,

after which, when the entire list of quantities is completed and the cost ascertained, the items of profit and expense are added. In the example illustrated in Fig. 4 the estimator must bear in mind that the pipes are not all on one plane, as indicated, but that the fixture centers are located on an average about fourteen inches from the wall where the pipes are concealed, and allowance of that length of pipe must be

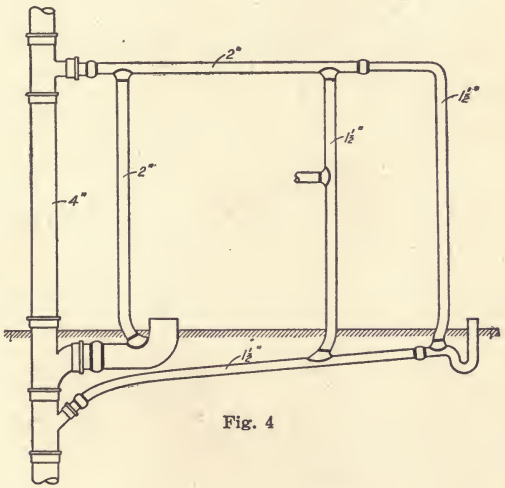

Fig. 4

made for each back vent or waste pipe where it crosses under the floor to intersect the main waste pipe. Keeping this in mind, the length of the different sizes of pipe can be scaled and the amounts jotted down. Having the amount of lead pipe, the number and sizes of traps, bends and ferrules should be noted.

The oakum and lead for calking the ferrules will be allowed for in the estimate of the soil pipe, so that

of all the materials for the lead roughing of this layout only the solder remains to be calculated. A common practice among plumbers is to allow one pound of solder for each wiped joint; but that method, at best, is but a system of guesswork. If the joints to be wiped are all small and the plumber who installs the work makes short, skimpy joints, an allowance of one pound might be entirely too much, while if the pipes are all large and the plumber wipes long heavy joints the allowance will be entirely too small. The best way is for the careful estimator to familiarize himself with the size and weight of joints wiped by the employees of his shop and either by measurement or weighing ascertain the average weight of joints on each size of pipe, then, making due allowance for solder that is lost in wiping or stolen from the job, a fair idea of the weight of solder to allow per joint can be formed. This is not so trifling and unimportant as it might seem, for the difference in amounts of solder used in different cities is considerable. For instance, around St. Paul, Minneapolis, Duluth and West Superior the average length of joints on $\frac{5}{8}$ lead pipe used to be about three inches, while at the same time in Chicago the same size joints did not average over 1 inch in length. It stands to reason, then, that if the 3-inch joint took only one pound of solder, the 1-inch joint would take but one-third of that quantity, and should be so calculated on. To give some idea of the carelessness of the pound-per-joint method of estimating, and at the same time show how to approximate the amount of solder used in a joint, reference is had to Fig. 5. This shows a section of 4-inch pipe cut in two lengthwise through a joint.

The solder in this joint is assumed to be $\frac{3}{8}$ of an inch thick, and $2\frac{1}{2}$ inches long.

To find, then, the approximate cubical contents of the solder it is necessary to find the length of the joint if rolled out into a straight line. The inside diameter of the pipe is 4 inches, the pipe $\frac{1}{8}$-inch thick and the thickness of the solder $\frac{3}{8}$-inch, so that the distance, (*a*), would be equal to $4+\frac{2}{8}+\frac{3}{8}=4\frac{5}{8}$ inches. This represents the diameter of the ring of solder

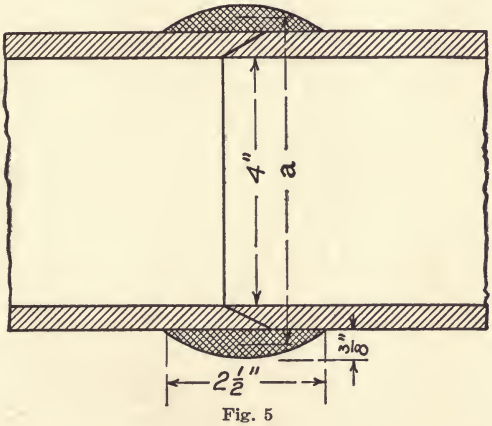

Fig. 5

forming the joint, and as the circumference of a circle is 3.1416 times the diameter, the length of the solder joint is $4\frac{5}{8}=4.625\text{x}3.1416=14.52$ inches. The joint extends $2\frac{1}{2}$ inches along the pipe and is $\frac{3}{8}$-inch thick, but it tapers from end to center, so that in the average joint, if spread uniformly over the entire surface, the solder would be, perhaps, about $\frac{1}{4}$-inch thick. If, then, the length of the joint be multiplied by the width and thickness the entire cubical contents

of the solder in inches will be found. Thus, in this case, 14.52x2.5x.25=9 cubic inches of solder on a 4-inch joint.

Solder, such as is used for wiping weighs approximately .352 pound per square inch so that the solder for a 4-inch joint would weigh 9x.352=3.168 pounds. It will thus be seen that allowing one pound of solder for a 4-inch joint entails a loss of over two pounds on each joint wiped not counting the solder tossed away in the process of wiping and never recovered. In view of this fact, and the further one that according to the same calculation a 2-inch pipe requires 1¾ pounds of solder it may be well to again emphasize the necessity for determining the actual amount of solder required for joints of various sizes and not depending on the pound-per-joint method which does not give even approximate results.

In the absence of exact data as to the quantity of solder required for wiping joints, an empirical rule, which will be found perfectly safe even allowing for loss due to flipping pieces of soft metal from the pipe, is to allow for each large joint one pound of solder for each inch in diameter of the pipe, and for pipes smaller than 1-inch in diameter, one pound of solder per joint. According to this rule the solder required for the work shown in Fig. 4 would be ascertained as follows:

	Pounds
One 4-inch joint	4
Five 2-inch joints, @ 2 lbs. per joint	10
Five 1½-inch joints, @ 1½ lbs. per joint	7.5
	21.5

Lead pipe is sold by the pound, so that once the quantity of the various sizes of pipe is ascertained it can be reduced to pounds by multiplying the lengths of the various sizes of pipe by the weights per foot. The weights of lead pipe of various grades can be found in Table XV.

TABLE XV

SIZE AND WEIGHT OF LEAD PIPES

Caliber	Weight per Foot	
	Pounds	Ounces
$\frac{3}{32}$-inch Tubing	..	$1\frac{1}{4}$
$\frac{1}{8}$-inch Tubing	..	3
$\frac{3}{16}$-inch Tubing	..	4
$\frac{1}{4}$-inch Tubing	..	6
Fish Seine	..	15
$\frac{3}{8}$-inch Aqueduct	..	8
Ex. Light	..	9
$\frac{3}{8}$-inch Light	..	12
Medium	1	..
Strong	1	8
Ex. Strong	2	..
$\frac{1}{2}$-inch Aqueduct	..	10
Ex. Light	..	12
Light	1	..
Medium	1	4
Strong	1	12
A. A	2	..
Ex. Strong	2	8
Ex. Ex. Strong	3	..
$\frac{5}{8}$–inch Aqueduct	..	12
Ex. Light	1	4
Light	1	12
Medium	2	..
Strong	2	8
Ex. Strong	3	..
Ex. Ex. Strong	3	8
$\frac{3}{4}$-inch Aqueduct	1	..
Ex. Light	1	8
Light	2	..
Medium	2	4
Strong	3	..
Ex. Strong	3	8
Ex. Ex. Strong	4	..

TABLE XV—(Continued)

SIZE AND WEIGHT OF LEAD PIPES

Caliber		Weight per Foot	
		Pounds	Ounces
⅞-inch	Aqueduct	1	8
	Ex. Light	2	..
	Light	2	8
	Medium	3	..
	Strong	3	8
1-inch	Aqueduct	1	8
	Ex. Light	1	..
	Light	2	8
	Medium	3	4
	Strong	4	..
	Ex. Strong	4	12
	Ex. Ex. Strong	5	8
1¼-inch	Aqueduct	2	..
	Ex. Light	2	8
	Light	3	..
	Medium	3	12
	Strong	4	12
	Ex. Strong	6	..
	Ex. Ex. Strong	6	12
1½-inch	Aqueduct	3	..
	Ex. Light	3	8
	Light	4	..
	Medium	5	..
	Strong	6	..
	Ex. Strong	7	8
	Ex. Ex. Strong	9	..
1¾-inch	Ex. Light	3	12
	Light	4	8
	Medium	5	8
	Strong	6	8
	Ex. Strong	8	..
2 -inch	Waste	3	..
	Ex. Light	4	..
	Light	5	..
	Medium	7	..
	Strong	8	..
	Ex. Strong	9	..
	Ex. Ex. Strong	10	8

Estimating Sheet-Lead Work.—Estimating the material for sheet-lead work, such as the lining of tanks with lead, is very simple. All that is necessary to find the amount of lead is to measure the square feet of surface to be covered and multiply the number of square feet by the weight of lead to be used. That will give the total weight of sheet lead required. Six-pound and 8-pound lead are the weights generally used for lining tanks. By 6-pound lead is meant a thickness of sheet lead 1 square foot of which will weigh 6 pounds. Four-pound to 6-pound sheet lead is generally used for safes, under fixtures and floors. One square foot of sheet lead $\frac{1}{16}$ inch thick weighs 4 pounds. Sheet lead is rolled in thickness so that it may be had in $2\frac{1}{2}$. 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$, 5, 6, 7, 8, 9, 10, 11 and 12-pound weights. If weights different from the foregoing are specified an extra allowance of 10 per cent. of the cost must be made to cover the extra charge of the manufacturers for special weights.

The solder required for wiping seams in tanks will average 3 square inches to the foot, which is equal to slightly over one pound per lineal foot of wiped seam. As considerable solder is lost in seam wiping, besides bulls-eyes to be wiped to hold the sheet lead in place, an allowance of $1\frac{1}{2}$ pounds of solder for each lineal foot of seam in the tank will be about right. One box of tinned tacks will be found sufficient for holding the seams in place in an average-sized tank.

In estimating the time required for lining tanks or other receptacles with lead, it is necessary for the plumber to know just what sizes of the various weights of sheet lead he can get, so he will know whether one sheet will do for an entire side, or whether the lead

will have to be patched out to cover a given surface. The sizes, weights and other information regarding sheet lead can be had from Table XVI.

TABLE XVI

WEIGHTS AND MAXIMUM SIZES OF SHEET LEAD

Weight Per Square Foot	Thickness in Inches	Maximum Sizes of Sheets
1 pound	1–64	8 feet by 20 feet
1½ pounds	1–43	8 feet by 20 feet
2 pounds	1–32	7 feet by 45 feet
2½ pounds	1–24	9 feet by 45 feet
3 pounds	3–36	10 feet by 45 feet
3½ pounds	1–16	10 feet by 45 feet
4 pounds	1–16 full	10 feet by 45 feet
5 pounds	5–64	10 feet by 43 feet
6 pounds	3–32	10 x 43 feet or 11 x 40 feet
6 pounds	3–32	11½ x 30 feet or 11¾ x 25 feet
8 pounds	⅛	10 x 40 feet or 11½ x 35 feet
10 pounds	1–6	11½ x 30 feet, 11 x 40 feet, or 10 x 48 feet
10 pounds	1–6	11½ feet x 40 feet
12 pounds	1–5	11 x 40 feet or 11½ x 35 feet
14 pounds	1–5 full	11½ x 40 feet or 11¾ x 30 feet
16 pounds	¼	11½ x 40 feet or 11¾ x 30 feet
20 pounds	¼	11½ x 40 feet or 11¾ x 38 feet
20 pounds	¼	11¾ x 36 feet
24 pounds	¼	11¼ x 30 feet
24 pounds	¼	11 x 34 feet or 11½ x 32 feet
30 pounds	½	11 x 27 feet or 11½ x 25½ feet
30 pounds	½	11½ x 24½ feet or 12 x 16 feet
40 pounds	⅔	11 x 24 feet or 12 x 16 feet
60 pounds	1	12 x 12 feet

CHAPTER II

ORIGINALITY IN ESTIMATING

USE of Stock Fittings.—It may be laid down as a general rule, to which there are only a few exceptions, that the entire work in a plumbing installation should be made up of standard stock pipe and fittings. This is particularly true in localities far removed from supply houses, for the carrying of special fitting necessitates the tying up of considerable working capital, without the excuse of it being necessary. For instance, single and double hub pipe, Y fittings, ⅛ bends, TY fittings and long-sweep ¼ bends are all that are necessary to be carried in stock. If special fittings are necessary for any operation they can be ordered with other materials for that work. With the fittings enumerated, an average workman should be able to rough-in any building; and using 45°-angle Y fitting does not lead to the confusion nor require the numerous fittings that go with Y branches of other degrees of angle. The foregoing remarks are applicable only to cast-iron pipe and fittings. When wrought-pipe systems are to be in-

stalled, a greater variety of bends are required than for cast-iron soil pipe.

It should be borne in mind that fittings should conform to the work, the work not have to be designed and laid out so as to use special fittings. If a fitting is not adaptable and capable of being used in almost any line of pipe, or in any position, it is not a suitable fitting to carry in stock, although it might possess great value as a special.

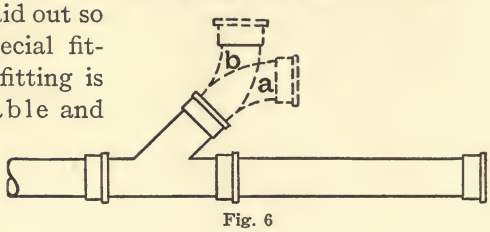

Fig. 6

The simplicity, economy and convenience of using only 45°-angle Y fittings and $\frac{1}{8}$ bends may be seen by referring to Fig. 6. When a 45°-angle Y fitting is used the branch itself will project a straight connection indefinitely at that degree of inclination from the main pipe. If, however, it is desired to continue the branch line parallel with the main pipe it can be done by using a $\frac{1}{8}$ bend and turning it in the direction shown at (*a*). If, on the other hand, the branch is to be continued at right angles to the main pipe, this can be accomplished by means of a $\frac{1}{8}$ bend, by turning it in the direction

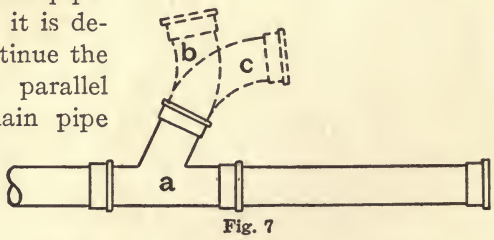

Fig. 7

shown by the fitting (*b*). If now, instead of a 45°-Y fitting a half-Y or 60° branch, (*a*), Fig. 7, be used, in order to project the branch at an angle of 45° from the main pipe, a $\frac{1}{32}$ and a $\frac{1}{64}$ bend would have to be used together to make up the sum of the 15 degrees the branch is away from a 45-degree angle. The two bends enumerated, a $\frac{1}{32}$ and a $\frac{1}{64}$ bend, together make up the sum of $11\frac{1}{4}+5\frac{5}{8}=16\frac{7}{8}$ degrees which is $1\frac{7}{8}$ degrees more than is wanted but is the best that can be done with the fittings obtainable. To turn the branch at right angles from the main a $\frac{1}{12}$ bend, (*b*), would be required, and to turn the branch parallel with the main a $\frac{1}{6}$ bend, (*c*), would be required. It will thus be seen that it is necessary to carry in stock four different degrees of bends, when half-Y fittings are made use of, and, as full Y branches and $\frac{1}{8}$ bends would naturally be carried in stock, this necessitates an expenditure of working capital for seven different kinds of fittings, where two would not only be sufficient but better.

It will pay the contractor to provide plenty of double-hub pipe on every operation, as it will save the waste entailed by cutting single-hub lengths of pipe. Even in cities where double hubs and single hubs are permitted, the lead, oakum and labor, required to calk a hub onto a piece of pipe will increase the cost to far more than that of double-hub pipe. True economy, then, lies not in carrying single and double hubs in stock, but in ordering a liberal amount of double-hub pipe.

Use of Special Fittings.—In this sense the word "special" is used not to designate fittings which are

made to order, but such stock fittings as are seldom used in practice. An examination of the fittings listed in plumbing catalogues will show that there are many kinds of fittings made which the average plumber never sees in his experience as a journeyman. The estimator, however, should familiarize himself with the various fittings, so as to have stored in his memory the various specials he can call upon to help lay out the work economically. A few examples of special fittings and their uses will help to make the meaning clear. The ordinary TY fitting, such as is used for water-closet outlets at the various floors of a building, are about 12 inches long from the center of outlet to end of fittings, and soil pipe is 5 feet long from the inside of hub to the end of pipe. If, therefore, a building to be roughed-in has 10-foot ceilings and 12-inch joists, as shown in Fig. 8, two lengths of pipe and the necessary fittings will just reach from floor to floor, so as to bring the outlets at their respective heights. If, however, the ceilings were over 10 feet in height, two lengths of pipe and an ordinary TY fitting would not be long enough, and under such conditions a short piece of pipe is usually cut from a double-hub length to piece out the pipe and bring the outlets to their proper levels. The careful estimator, however, who is posted as to special fittings, knows a trick worth two of that. Instead of cutting a length of pipe for the soil and vent stacks at the various floors, he uses long TY branches for the soil and waste pipes, and long T branches, to bring the waste and vent outlets to their proper heights. By this means he saves the extra lead, oakum and labor required to cut and insert a short piece of pipe,

eliminates two joints at each floor, thus reducing the possible cost of repairing leaky joints when the test is applied, and the extra length of fitting costs no more than an equal length of soil pipe. In the case of a 5-inch soil stack and accompanying 3-inch vent stack the lead required would be 8 pounds, which at 4 cents per pound would cost 32 cents. Add to this the cost of oakum and gasoline, together with the labor of cutting pipe and making the joints, which would average over an hour, at, say, 65 cents per hour for plumber and helper, and one dollar per floor can be figured as saved on each double line of stacks. In many tall buildings there are a number of stacks, and if, for example, a building having eight such floors be assumed, and twelve double lines of pipe extending from the cellar to roof, there would be a

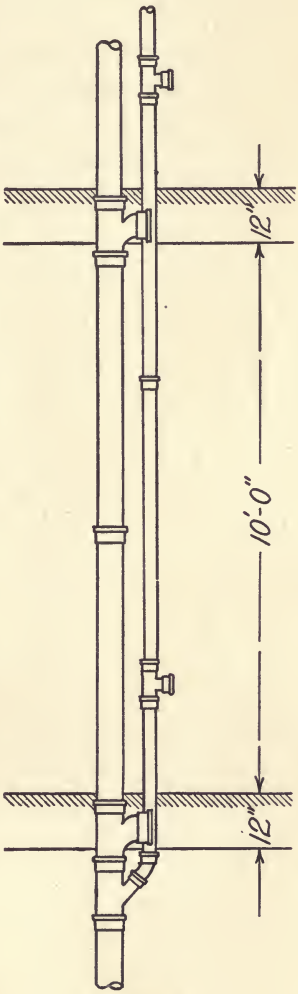

Fig. 8

saving of 8 x 12=$96 approximately in just this one item of cost.

It was stated, when explaining how to take off quantities from plans, that fittings in the groundwork should be measured as soil pipe. That is true, for, besides the reasons stated, the work cannot be laid out on plan so as to show exactly the way the lengths will be disposed, and some allowance must be made for changes. If the work could be laid out accurately, the same as for rising lines, the exact amount of pipe required would be ascertained and estimated upon.

Fig. 9

Fig. 10

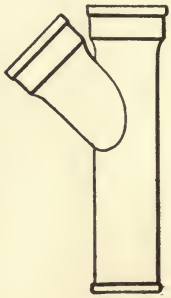

Fig. 11

That is what the careful estimator would do with rising lines when he can figure the exact amount of pipe required to reach from fitting to fitting on the several floors.

Long T branches are shown in Fig. 9, and the sizes they may be had in are given in Table XVII. Long TY branches are shown in Fig. 10, and the sizes they may be had in are indicated in Table XVII, while Y branches of long pattern are shown in Fig. 11 and the sizes they are made in are given in the same table.

Long 4-inch $\frac{1}{8}$ bends, Fig. 12, also $\frac{1}{6}$ bends are made, but only in lengths of 18 inches. Long quarter bends but not long-turn quarter bends are shown in Fig. 13, and long quarter bends with foot-rest are shown

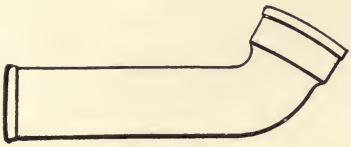

Fig. 12

Fig. 13

Fig. 14

in Fig. 14. The size and length that they may be had in can be found in Table XVIII. A double Y fitting with side outlet can often be advantageously used on vertical stacks of soil pipe. Such a fitting is shown in Fig. 15. The sizes in which it may be had are given in Table XIX. Double angle Ys, Fig. 16, are likewise very convenient in some work and should be borne carefully in mind. They may be had in the sizes stated in Table XX

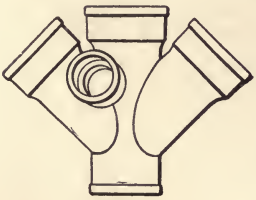

Fig. 15

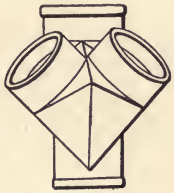

Fig. 16

TABLE XVII

LENGTHS AND OUTLETS OF LONG Y, TY AND T FITTINGS

4 x 4, 24 inches long	5 x 4, 36 inches long
4 x 4, 30 " "	6 x 4, 24 " "
4 x 4, 36 " "	6 x 4, 30 " "
5 x 4, 24 " "	6 x 4, 36 " "
5 x 4 30 " "	

TABLE XVIII

SIZE AND LENGTHS OF LONG QUARTER BENDS

2 inch, 14 inches long	5 inch 18 inches long
3 " 15 " "	6 " 18 " "
4 " 18 " "	8 " 18 " "

TABLE XIX

SIZE OF DOUBLE Y FITTINGS WITH SIDE OUTLET

4 x 4 with 2-inch Outlet	5 x 2 with 2-inch Outlet
4 x 3 " 2 " "	6 x 6 " 2 " "
4 x 2 " 2 " "	6 x 5 " 2 " "
5 x 5 " 2 " "	6 x 4 " 2 " "
5 x 4 " 2 " "	6 x 3 " 2 " "
5 x 3 " 2 " "	6 x 2 " 2 " "

TABLE XX

SIZES OF DOUBLE ANGLE Y'S

4 x 4 inch	5 x 4 inch	6 x 6 inch

Fig. 17

In Fig. 17 is shown a fitting with four outlets all of the same size. This type of fitting will be found very convenient in many installations, and, although the design might be vastly improved, still, as it is, the fitting is perfectly sanitary.

Besides the special cast-iron soil fittings the estimator should bear in mind the special lengths of lead traps and bends. Long ½-S traps, similar to Fig. 18, may be purchased

at the additional price of what the extra pipe would cost, and thus save the labor and solder required to make a joint to piece the trap out so it will reach to the wall. These traps are made in $1\frac{1}{4}$, $1\frac{1}{2}$ and 2-inch sizes, and are 15 inches long over all. Long, full-S traps, as shown in Fig. 19, may be had in $1\frac{1}{4}$, $1\frac{1}{2}$ and 2-inch sizes, measuring 24 inches over all. As sinks and lavatories are set 2 feet 6 inches above the level of the floor, a trap 24 inches long will easily reach from the fixtures outlet to the floor.

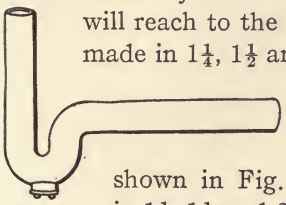

Fig. 18

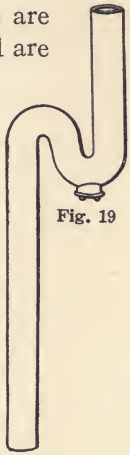

Fig. 19

Of the different types of lead bends that are made, each has advantages when used in certain positions. There is no economy in ordering an ordinary short lead bend, such as is shown in Fig. 20, and then piecing it out with a short length of lead pipe. The better practice is to purchase either long bends Fig. 21 or extension bends Fig. 22; extension bends are made in the sizes indicated in Table XXI.

Fig. 20

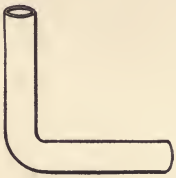

Fig. 21

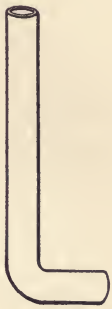

Fig. 22

In addition to the special fittings pointed out, there are a number of patented special fittings made which can sometimes economically be worked into a stack, although they are not desirable fittings to carry in

TABLE XXI

DIMENSIONS OF EXTENSION LEAD BENDS

5½ x 12 inches	10 x 15 inches
5½ x 15 "	10 x 18 "
5½ x 18 "	

stock, as the stacks must be designed for their use, they not lending themselves to the building up of an ordinary stack. The enterprising estimator and contractor will keep himself posted in the designs of such fittings, and be familiar with their dimensions so as to use them when conditions warrant.

It might be well to state in this place that bends are now made with one end spun tight, ready for testing. At the prices charged at present for spinning these ends shut—that is, thirty cents each—it is doubtful if there would be any economy in their purchase; when, however, these are sold at the regular price of lead bends, plus the cost of the extra lead required for closing the head, there will be economy in the use of such bends.

Another matter, which may at some time prove profitable to know, is that where special fittings, which are not carried in stock, are required they can be had upon paying the additional cost of a pattern, with, perhaps, a little extra for the trouble. The possibility of having special fittings made should not be forgotten, as occasions might arise in large installa-

tions where economy would be effected by having special fittings cast.

Economizing Pipe.—When plumbing details of the roughing-in of various toilet rooms form part of the working drawings in a set, there is not much choice left the plumber but to comply with the requirements. When, however, leeway is given him to lay out the work for himself, as is the case in 99 per cent. of plans now prepared, simplicity in design should be

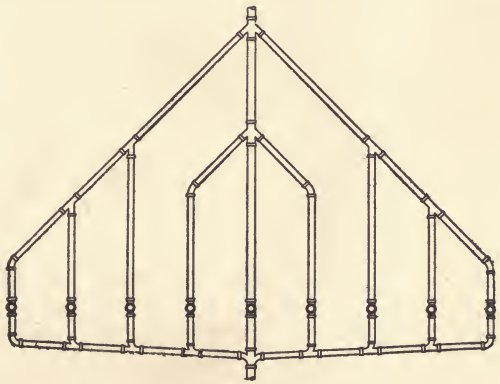

Fig. 23

his aim; for every foot of pipe that is not absolutely necessary to an installation, instead of improving the work, is actually detrimental besides unnecessarily increasing the cost. This is well shown by the two following examples: Fig. 23 shows the layout for nine lavatories actually installed according to this design. To rough-in this work a number of angle fittings, such as $\frac{1}{8}$ bends, and Y branches, were used which require more care and time to measure

and install than do equal amounts of pipe made up with right-angle fittings. As the angle fittings in this case did not contribute one bit to the efficiency of the installation their use was unnecessary. Owing to the height that the vents are carried before intersecting the main stack, the workmen had to build a scaffold, and in addition to the time wasted in this labor the extra time required to do a certain work on a staging must be considered. Again, more fittings and a greater amount of pipe were used to install this work than would be required to install it according to

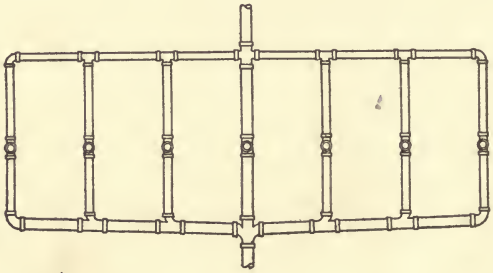

Fig. 24

Fig. 24, where all the work is easily accessible from the ground and in which the installation would be equally sanitary and far less costly. It will readily be seen, therefore, that of two men estimating on this installation the one figuring on doing the work according to Fig. 24 would effect quite a saving over the one estimating to do the work according to Fig. 23.

Study the layout of all the work you have to install, cultivate the practice of laying out on paper the roughing-in for each group of fixtures, and change,

rearrange and alter the drawing until the very best arrangement, requiring the least amount of pipe, fittings and labor, is obtained. After a time, the planning of work will become a pleasure and the saving effected will go a long way toward securing work.

Locating the Vertical Stacks.—In deciding where to extend the soil and vent stack up through the toilet rooms or bath rooms on the various floors of a building the arrangement of the fixtures must be carefully studied and the stacks so located that there

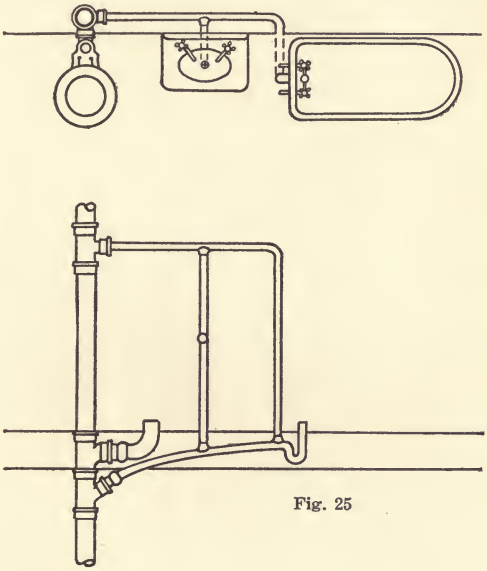

Fig. 25

will be no crossing or recrossing of pipes, no close work or complicated network of pipes to contend with, and so long horizontal runs can be avoided. It is a good rule to locate the rising lines back of or close to the

water closet, and if this cannot be effected with the layout of fixtures shown on the plans permission might be given to rearrange the fixtures so as to avoid long and complicated runs. Further, when possible to so arrange it, the lavatory should be located next to the closet, then the bath tub, as by this layout of fixtures less time and material are required to rough-in the work than when the bath tub is located be-

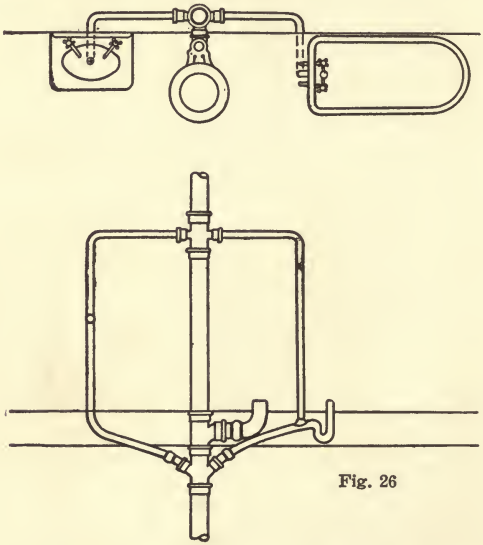

Fig. 26

tween the lavatory and closet. To show the economy effected by a study of the fixtures some simple cases are here illustrated. The examples shown are made simple so as to emphasize the points, without complicating the text. The arrangement of fixtures in a single bath room on one floor only of a building is shown in Fig. 25. As here arranged the water closet,

lavatory and bath tub follow in their proper order and the stack is located back of the water closet. The arrangement of soil and waste pipes for the layout of fixtures is shown in the same illustration. In this work there are no long runs, no crossing of pipes, and the fittings, lead pipe and brass goods required are reduced to the lowest limit, while owing to the simplicity of the work but little labor would be required to install the pipe.

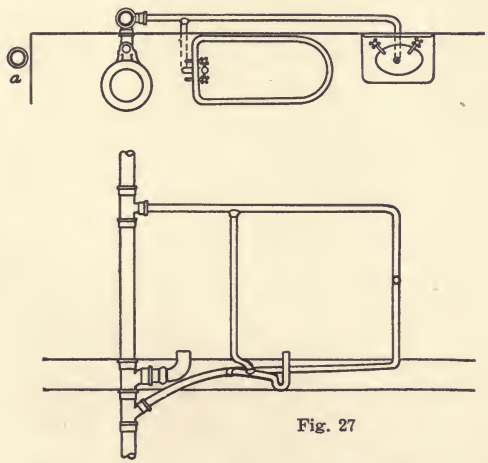

Fig. 27

The same bath room with a different arrangement of fixtures is shown in Fig. 26. Here the water closet is located in the center, the lavatory on one side of it and the bath tub on the other side. This arrangement of fixtures as may be seen by the illustration, requires a little more pipe than in the former layout, besides requiring two extra 2-inch brass ferrules and two double fittings instead of single ones. The labor is about equal in both cases.

In Fig. 27 the same bath room is shown with the bath tub placed between the water closet and the lavatory. As may be seen by the arrangement of pipes, this layout requires about 12 feet more pipe than either of the two former arrangements, and 12 feet of 1½-inch pipe weighs 36 pounds, which at 4 cents per pound would run the cost of material $1.44 higher than the first layout, besides the cost of extra time required to install the pipe according to this layout. In addition to the waste pipes, 12 feet extra of water supply pipe would be required for a bath room with fixtures so arranged, and this arrangement with its extra expense, instead of providing a better layout, is actually worse.

It will require but little study of the foregoing illustrations to show that if the soil stack were located at any other point than back of the closet more material and labor would be required to install the work. For instance, if the stack were in the wall to the left of the water closet, as shown at (*a*), in Fig. 27, it would not only take more material and labor to rough-in the bath room, but more bends would be required, which should be avoided as much as possible. The partitions in which soil stacks are located are generally shown on the plans as being 4 inches thick. This is due merely to the common practice of making the partitions on the plans all of one size, not because the architect insists that nothing larger be used. If the matter is taken up with the architect as soon as the contract is signed deeper partitions will be provided, so that all of the pipes can be easily concealed and horizontal pipes run without weakening the studding too much when pipes are notched

in. Where a soil and vent stack can be run together it is well to have a 6 or 8-inch partition, as the case may require; then, instead of running the pipes side by side, place one a little back of the other, as shown in Fig. 28, so that their branches can cross without

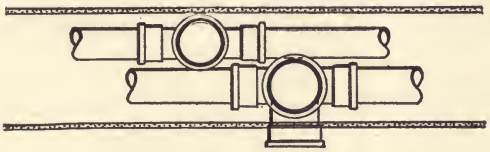

Fig. 28

interfering with each other. The convenience of such an arrangement of pipes will save much time on the item of labor. It is well to arrange the pipes in that manner, whether or not they are to be concealed in partitions.

Rearranging the Fixtures or Stacks.—Most plumbing plans are prepared by a draughtsman who knows very little about the niceties of plumbing design and who gives the layout but little study. Consequently, very few sets of plans are submitted for estimates which cannot be improved upon. In some cases architects wish their drawings followed closely, whether or not the layout is economical; but when the architect will permit changes to be made and the contractor is at liberty to improve the installation much material can often be saved. A few examples will be given to illustrate the way fixtures and stacks may be changed in order to economize material and labor.

In Fig. 29 is shown the layout of fixtures in the bath rooms and kitchens of a row of flats. A line of 5-inch soil pipe, with an accompanying 3-inch vent stack, was planned for the two bath rooms on each floor, and a line of 3-inch waste pipe accompanied by a 2-inch vent stack was to be run for the kitchen sinks and laundry tubs. In estimating and installing the work the estimator dispensed with the waste and vent stacks for the sinks and laundry tubs, and by rearranging the fixtures and changing the location of the soil stack to the position shown in Fig. 30 effected a better and, at the same time, more economical installation. In planning the work a double angle Y, similar to Fig. 16, was used for outlets to the two closets, and a double Y with 2-inch branches calked into the angle Y, provided outlets for the kitchen fixtures on one side and the bath tubs and lavatories on the other. By this arrangement of fixtures and stacks not only were the time and material which would have been required for the separate kitchen stacks saved, but that saving was effected without the use of an extra fitting on the soil stack and with a consider-

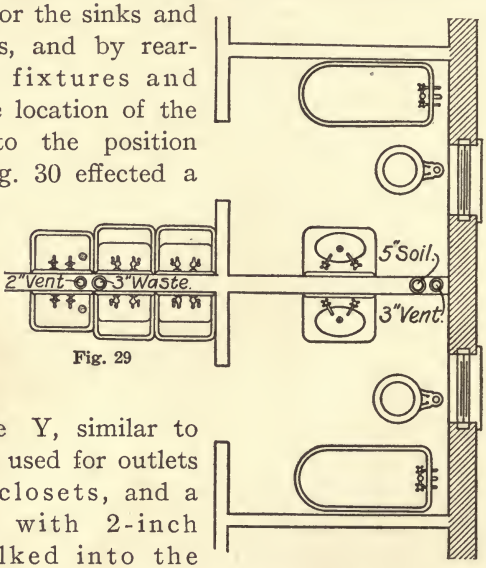

Fig. 29

able saving of labor roughing-in the bathrooms, which were made simpler by the change.

In roughing-in the work provision was made for an 8-inch partition in which to conceal the pipes, and nothing showed in the respective rooms but the short lengths of pipe from fixtures to wall.

Another example of the economy of rearranging fixtures may be cited in the case of a hotel in which the work, as originally laid out, was to have been as shown in Fig. 31. The illustration is a reproduction of the original drawing, showing the layout of fixtures and run of pipes for each of the 100 bath rooms. Owing to the soil stack having been indicated as exposed in a closet to one side of one of the bath rooms it became necessary to run all the roughing-in pipes under the bath room ceilings and all exposed. How the vent pipes were to be run was not shown, but no matter; by the time they were in, the partitions around the bath rooms would have been a network of pipes. It will be observed that under the ceiling of the bath rooms on each floor about 15 feet of 4-inch soil pipe would have to be run and supported with

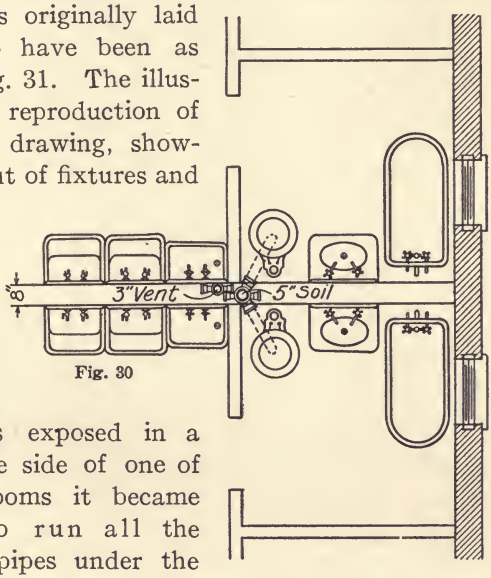

Fig. 30

hangers, while 5 branches and about 20 feet of 2-inch pipe would likewise be required. All of this unnecessary piping was saved, the work simplified and hundreds of dollars' worth of labor economized by rearranging the fixtures as shown in Fig. 32 and running all the pipes in the partitions, which were made deep enough

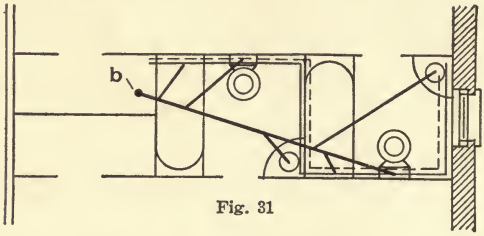

Fig. 31

to conceal them. In addition to the saving effected by simplifying the design, no drainage pipes were exposed in any of the bath rooms, closets or other rooms of the building, but were concealed, as they should be, for large drain pipes are far from being ornamental in rooms.

Estimating Labor.—In the estimating of plumbing work the one uncertain item of expense is the labor. This is due to two causes. In the first place, all workmen are not equally good designers, and those who do not plan the work far enough ahead are liable to so complicate the installation as to necessitate from 10 to 20 per cent. extra labor and material. This difference between the efficiency of men can be equalized, however, by carefully preparing working drawings for work where there are no detail drawings furnished with the plans. By this practice all workmen in the shop are put upon the same footing, and

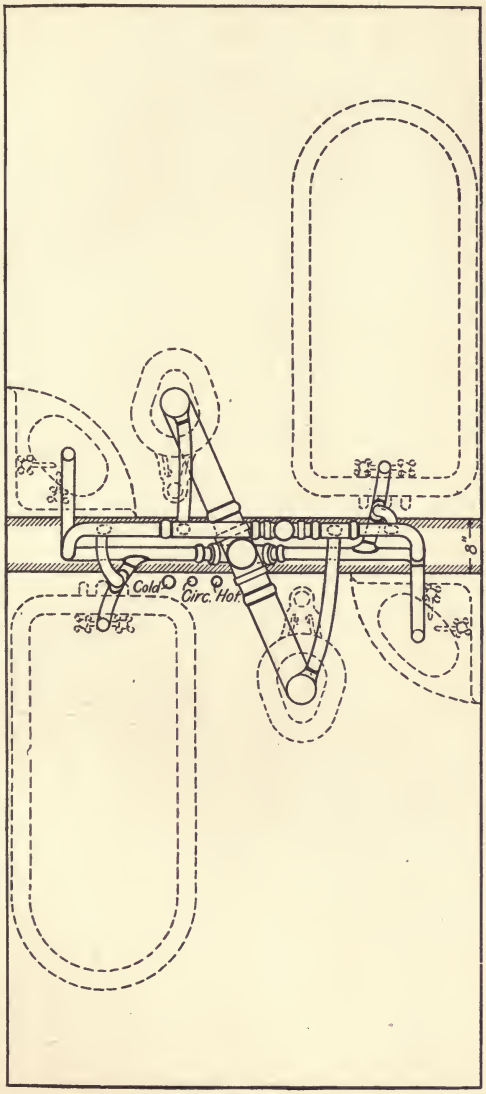

Fig. 32

better, as well as more economical, results will be obtained. But even when working on exactly the same kind of work, some workmen accomplish more than others and do it with such ease that it shows they belong in a higher class. Indeed the difference in quantity of work is not confined to individuals, but is true of shops. Some contractors employ only the best of workmen, to whom they often pay more than the prevailing rate of wages, while others are contented with whatever men they can get, so long as they will work for, or below, the prevailing scale of wages. It follows, therefore, that there is an average day's work of all the workmen engaged in the business, and that there is an average day's work for the workmen in each shop. To the careful estimator, the average day's work for the craft is of little use. He wants to know the capacity and limitations of the workmen in his own shop, as that is what he must be guided by. In every shop there are swift workmen and slow workmen, and in basing his estimate he must not accept as a standard of quantity what can be performed by the fastest workers in his employ. If he does the item of labor will show a deficit when the contract is completed, for all of his workmen will not live up to his calculations. On the other hand, the output of the slowest workmen must not be taken as a standard. If it is, too much labor will be allowed for, and the bid might be too high to secure the contract. The only safe way is to figure out what the average output of the men might be and use that as a basis for calculating the labor.

When a contractor first starts in business, and before he has secured work and organized a working force, he must have some basis on which to calculate the cost of labor. For the benefit of such individuals, as well as for whatever other good it may do, the approximate amount of work of various kinds which can be performed by the average workman, together with ways of checking the estimate, will be given.

In running cast-iron soil pipe in the ground, where the trenches are dry, no measurements to be taken, pipe to be cut or fittings to be inserted, an average workman should be able to calk 24 joints of 6-inch pipe, which would be equal to 120 lineal feet. If running 5-inch pipe he should be able to calk 140 lineal feet, and if small pipe, 160 lineal feet. Where, however, measurements must be taken, the building prepared to receive the pipe which must be cut and calked, 12 joints of 6 inch, 15 joints of 5 inch, 18 joints of 4 inch, 20 joints of 3 inch or 22 joints of 2 inch would be about an average day's work. That allowance should be sufficient, even when the pipes are to be run under ceilings, or placed in any other part of a building where the work would be considered difficult of access. In tall buildings, where companion stacks of soil and vent pipe are extended from the cellar to the roof, the plumber and his helper should be able to carry a 5-inch soil stack and 3-inch vent stack two stories in height each day.

It might be well to state that in the foregoing allowances it was assumed that the journeyman had for an assistant an apprentice or helper.

The amount of wrought pipe that can be handled should be judged in each case from the layout of the

work, and the amount of cutting and fitting required. It is obvious that the quantity of work in the line which represents a day's labor cannot be stated in feet, because in some parts of the installation 40 or 50 pieces of pipe might have to be cut and fitted to use up only about 30 feet of pipe, while in other cases hundreds of feet of pipe might be installed without cutting half a dozen threads. When the pipe is fairly easy to install all in full length and with but few fittings, such as pump pipes and overflow pipes, 100 feet of 2½ and 3-inch pipe would be a fair day's work, and 80 feet of 4 and 5-inch pipe, or 60 feet of 6 to 8-inch pipe would likewise be considered a good day's work.

In work such as the usual labor of installing wrought-pipe drainage systems, where the large sizes of pipe are cut by a machine, the measuring and installing of 12 pieces of 4-inch, 4½-inch, 5-inch or 6-inch pipe would be a fair day's work. Fourteen pieces of 3-inch or 3½-inch; 18 pieces of 2-inch, measured, cut, threaded and installed, or 24 pieces of 1¼ or 1½-inch, measured, cut, threaded and installed, would constitute a fair day's work.

In the running of water-supply and drip pipes 32 pieces of ¾-inch or 1-inch pipe, measured, cut, threaded and installed, would be a fair day's work, while one-half of that amount, or 16 pieces, would represent a fair day's work installing the same size of polished brass or nickel-plated brass pipes. For ⅜-inch or ½-inch pipe 48 pieces would not be a large day's work for wrought iron, while one-half that amount of brass or nickel-plated brass pipes could be installed.

When estimating the labor roughing-in lead work, 8 wiped joints are generally considered a day's work. By referring to Fig. 25, which shows the roughing-in for a bath room, it will be observed that there are 8 wiped joints on the lead pipes, and that amount of work would be considered an average day's work As a matter of fact, a good workman would rough-in the lead work of two such rooms in one day.

Referring to the same figure, it will be further noted that the vent connections for all the fixtures are installed and all that will be necessary to connect the basin to the drainage system will be 2 wiped joints, while the bath tub will require but one. It may be assumed, therefore, that the three fixtures in the bath room can be set and connected up complete with water supply in one day, It is assumed that the rising lines of water supply are already installed and outlets left in each room.

If, instead of roughing-in the lead work as shown in the illustration, the stacks were run and short pieces of lead pipe extended through the plaster so the lead roughing would have to be done at the time the fixtures were set, the three fixtures could not be set in one day and more time would have to be allowed for roughing-in and finishing the bath room.

Checking the Estimate for Labor.—Noting the time required for roughing-in the lead work and setting the fixtures in the bath room will show the estimator how the labor he estimates for any building can be checked.

The roughing-in for the three fixtures cited took one day, and another day was required for setting the

fixtures. That makes two days for three fixtures, or two-thirds of a day for each fixture. By allowing, now, one more day to a bath room, or one-third of a day for each fixture for the time required installing the house drain, running the stacks, branches, water pipes, pump pipes and doing other work of a similar nature, it makes an average of one day's labor for each fixture in the building. Counting the number of fixtures, therefore, and comparing the number with the days allowed for one workman to do the work will show whether any serious error has been made in his calculation of time. If he has allowed either more or less days than there are fixtures, and the difference is great, he is put upon inquiry to go over his figures again to learn the cause of the discrepancy or find the error, if there be one.

It must be borne in mind that the foregoing explanation is given merely to illustrate, and cannot be depended upon as a check in all cases. In flat buildings, hotels, office buildings and other structures where the fixtures are pretty well bunched, the day-per-fixture rule will serve very well for a check. In buildings, however, where the fixtures are scattered and most of the labor is in the roughing-in, or where heavy, elaborate and unusual fixtures are installed, the same method can be employed, but a different allowance must be made to suit the case.

Each estimator should compile for himself a schedule of time required for different classes of buildings where he has installed the work, and from this data obtain coefficients that will show in his individual shop what time to allow per fixture, as a check on different classes of work.

When estimating the labor for a building, the materials of which the structure is built and the quality of the material must be carefully looked into. This is of more importance in old buildings than in new, although it is a point well worth considering in any case. Many of the old Government buildings which were erected to endure for centuries have walls, floors, partitions and roofs of such hardness that a day will often be required to cut through the mason work, where in ordinary structures a half hour would accomplish the desired result. A reinforced concrete building, likewise, is much harder to install a plumbing system in than a frame house, for the cutting for pipes, hangers and other purposes requires a much greater expenditure of labor.

Again, it might be well to emphasize the fact that the estimator who depends on the average day's work of the craft will lose most of the work he estimates on. Averages are good as a check and as a basis for arriving at the real capacity of workmen, but averages are not to be depended upon in estimating. The rule is, know your men, know your buildings and understand fully the work to be performed,then from the fulness of this knowledge figure out the number of days required to do the work by one of the average workmen in the shop. Having determined this quantity, check it with the fixture-per-day rule, applicable to the building, and there will be little danger of going astray on the cost of labor.

Estimating Catch Clauses.—In many specifitions the estimator will find paragraphs to the effect that a certain well-known first-quality fixture or one

"equally good" will be required, and he is at a loss how to estimate under the circumstances.

The question which naturally arises in his mind is, what will the architect consider "equally good?" Sometimes such a condition is innocently or ignorantly inserted in a specification instead of specifying two or more makes of goods, any one of which will be acceptable by an architect who wishes to give his client the benefit of competition but does not know just how.

More often, however, it is a catch clause, inserted to give some one the benefit in estimating. If the favorite is awarded the contract a cheap grade of goods can be substituted as "equally good" instead of better quality and more expensive fixtures specified as a standard. Should, on the other hand, some competitor who was not approved by the architect be awarded the contract, no matter what he estimated on, or how good the quality of goods offered, they would not be accepted because they were not, within the architect's understanding, up to the standard or "equally good" as those specified.

Verbal instructions before the contract is let, that a certain sample submitted will be acceptable, cannot always be depended upon unless a note to that effect is made in the specifications; consequently, the plumbing contractor, in order to protect himself in such cases, must estimate on furnishing the goods actually specified, not something "equally good". It is better to lose the contract without losing money than to be awarded the contract and lose money.

Another form that catch clauses sometimes take is not to specify any certain make of goods, but to

call for certain articles of a kind to be approved by the architect. Such a condition in a specification is hard to estimate on. For instance, in places where rough-body, iron-wheel, hard-seat globe valves are generally used the architect might insist on finished nickel-plated brass gate valves with wooden wheels. Usually, when such a clause is made part of a specification, the architect or his representative is too busy to pass upon the quality of the work before the contract is awarded, and the estimator has absolutely no information that will guide him in arriving at a price. Under such conditions the only alternative is for the estimator to figure on using a quality and kind of fitting or fixtures that will protect himself no matter what goods the architect might call for.

There are many such little catch clauses worked into some specifications, and the more of them present the more careful must the estimator be. There is no reason why anything in a plumbing specification should be left open for future decision or should be left vague or indefinite. It is an easy matter to state just what material will be required, or several of like material, any or all of which will be acceptable. Where an architect sees fit to do otherwise he might be innocent in his intention, but the estimator must judge by the wording of the specifications and, to protect himself, figure on the most expensive material that can reasonably be insisted upon.

Allowance for Salvation Clauses.—When an architect or engineer is incompetent to prepare plumbing plans and write the specification so as to cover fully all the materials to be furnished and the work he wants

done, he covers his incompetency at the expense of the contractor by inserting a clause giving himself unlimited power. That is a salvation clause. Usually, while unable to write a specification, that type of architect or engineer is quite proficient at the wording of salvation clauses, so that the most innocent seeming statement leaves it in his power to decide how much work and what material are to be furnished according to the plans and specifications. A usual form of salvation clause is the statement: "The work shall be under the general supervision of the architect, whose decision as to the true intent and meaning of the drawings and specifications will be final and conclusive." At some other part of the specification the clause: "All work and material must be first class in every respect, and to the satisfaction of the architect." Combining these two conditions gives the architect such power, together with what he may usurp, that in operation they generally insist that anything they wish done, no matter how whimsical and unreasonable, is part of the contract, because without it, *in their opinion*, the work would not be first class, and they are the ones to decide the point.

Such a clause is a dangerous power to place in the hands of an unscrupulous man, and generally those who resort to such unreasonable subterfuges are not overburdened with scruples. It is well to beware of the terms "first class" in a specification. It is an unnecessary term, at best, for if the plans are properly prepared, and the specifications properly worded, the two combined will show conclusively the quality of

materials and class of work to be furnished and the combined salvation clauses can be omitted.

The salvation clause is simplicity itself in operation. If for any reason the designer does not like the work as laid out, if he conceives of a way the work can be made more costly without adding one bit to its appearance or efficiency, if, in short, any way presents itself so the contractor can be harried into additional expenses which will use up all of the profit figured on, and some of his own money, depend on it that that type or architect or engineer will insist on the work being done; for it is the boast of that class of individuals that no contractor ever makes a profit on their work. To enforce their orders payment is refused until their dishonest demands are complied with. It is gratifying to say, however, that the salvation-clause architect is the exception. Most architects insist on good work, but are willing to have the contractor make a fair profit on their contracts.

When salvation clauses are found in a specification the estimator has the alternative of two safe courses. He can either refuse to estimate on the work, thus saving loss of time, worry and loss of money should he secure the contract at his usual price, or he can follow the example of those who have learned by experience and, after finding his cost, double it and add from 50 to 100 per cent. to his bid, indifferent whether he is awarded the contract or not.

Allowing for Incidentals and Sundries.—No estimator, no matter how careful he may be, will be able

to foresee all the material that will be required for a certain operation or who can foretell all items of expense. The caving of a trench which is being dug, damage to pipes by other workmen, breakage of fixtures, split pipes or fittings, defective work of any kind which must be made good, delay waiting for an inspector are all items of possible expense, any one or all of which might turn up to increase the cost of installation. In addition there are sundry items—such as screws, putty, red or white lead, graphite and other small articles, the cost of which is but slight when taken separately, but in the aggregate amounts to a tolerable sum. In order to cover all these items of expense an allowance, usually of a lump sum, is made under the classification of "Incidentals and Sundries."

The amount of the allowance, of course, will depend on the size of the operation, but should not be large for any size of building. All the known items of expense entering into the installation having already been determined a small allowance will do for incidentals, for twenty-five dollars will go a long way in purchasing the small items which have been overlooked in an ordinary-size job. The only reason for considering such materials is the desire of determining as nearly as possible the total net cost of the operation to the contractor. Whatever profit he figures on making he wishes to be free and clear, not cut down to a fraction of what he is entitled to by oversight in not allowing for all materials and contingencies.

Allowance for Board and Car Fare.—It is necessary to allow for the item of board only when the

operation is out of town and workmen must be sent to the site to live during the installation of the work. In allowing for board for the workmen the estimator must not forget that a number of trips will have to be made to the building by the contractor during the progress of the work, and that his hotel and traveling expenses are just as much items of cost as are the fixtures to be supplied. Usually an allowance of five dollars per day is made by the contractor for hotel expenses for every day he is at the building, and to this amount must be added his car fare, including a berth in a sleeper if the distance warrants it, or, at all events, a chair in the parlor car.

Car fare must be allowed for the workmen to and from the location of the work and, as they will have to go first to rough-in the building, then to set the fixtures, an allowance of two fares, going and coming, for each of the workmen who will be sent must be made. In order to determine the number of workmen that will be required at one time, the time allowance in the contract and the number of men that can be economically worked at one time must be considered.

Sometimes both board and car fare can be omitted from the estimate when the work figured on is in a large city and local workmen can be secured without trouble. When, however, a contractor has a good crew of men whose capacities he knows and on whom he can depend, he will find it more economical, as well as more satisfactory, to send his own workmen and give them the benefit of their board. On suburban work, where more than one five-cent car fare is required to take a workman to the building, car fare should like-

wise be allowed. The unusual distance will get the workman up earlier than usual in order to reach his work, and he should not have imposed on him this additional burden of paying extra car fare.

Allowance for Guaranteeing Work.—In some specifications there is a clause requiring the contractor to guarantee the installation against defects in workmanship and material for a certain period of time, usually from one to two years, after the completion of the contract. The careful estimator for a responsible contractor will not brush this condition lightly aside without considering it, but will give the item the proper charge in the cost column. Outside of the output of a very few manufacturers no goods entering into a plumbing installation are guaranteed, and of the few makes of fixtures which are, the guarantee covers only the replacing of the defective fixtures with new ones, but does not allow for the labor and materials necessary to make the change.

It will be seen, therefore, that when the plumber is called upon to guarantee work done under his contract he is called upon to guarantee materials that the manufacturer will not take that chance on, and if he is to stand sponser for other people's wares he should be paid liberally for the risk he runs. The contractor has no choice in the selection of his goods, which are specified by the architect, and having no alternative in the matter when he puts in the goods called for his work should end. If the goods themselves are inferior, so long as they are what are specified, no blame should attach to the contractor. He follows directions, and, having done so, if he is to be held

responsible for the poor quality of the work turned out by some manufacturer he is entitled to payment for the responsibility.

The estimator should keep himself well posted as to the quality of the several goods on the market, and, in proportion as the goods called for are reliable or not, he should add to the sum charged under the item of "guarantee."

Where the contractor acts as guarantor, even under the most favorable circumstances when the goods are guaranteed, he is still out of pocket, for he must replace the defective goods at his own cost. Where the goods are not guaranteed by the manufacturer he has to stand not only the cost of replacing the defective goods but also the purchase of new fixtures to replace the defective ones.

Some specifications require that not only shall the contractor's work be guaranteed against defects in material and workmanship, but, furthermore, any damage caused to the building, finishings or furnishings by a defect in material or workmanship shall be made good by the contractor. This places upon him the additional burden of insuring the building against damage, and in such cases an extra allowance must be made to cover possible damage that might occur. The estimator should remember in this respect that it is possible, and not probable, damages he must allow for, so as to be on the safe side.

Allowance for Operating Expenses.—In the conducting of a business there are sundry items—such as rent, light, fuel, clerk hire, bookkeeping, stationery, delivery horse and wagon, advertising, display,

salary for the contractor and uncollectable bills—which are charged against the business and are as much items of expense to charge against the several contracts as the fixtures that will be installed in the several buildings.

The only question to determine is the exact amount which must be charged against each operation. Contractors who have been in business for a few years know about what percentage their operating expenses are of the gross amount of work performed, and allow that percentage when estimating new work. For instance, if the annual operating expenses tabulate about as follows:

Rent	$ 600
Light	60
Fuel	80
Clerks	600
Bookkeeping	750
Stationery	35
Horse and Wagon	375
Advertising and display	400
Bad accounts	300
Total	$3,200

and the volume of business per year amounts to $50,000, the operating expenses would amount to $6\frac{4}{10}$ per cent. of the business contracted for, and, in estimating new work, under the item of operating expenses an allowance of $6\frac{4}{10}$ per cent. of the estimated cost of the work should be made. If this allowance were not made, and 10 per cent. profit were figured on the operation, the actual profit earned would be less than $3\frac{6}{10}$ per cent., for the other $6\frac{4}{10}$ per cent.

would go to defray the operating expenses of the business.

When a contractor starts in business he has no means of knowing just what his operating expenses will be. However, he can make a pretty fair calculation, basing his estimate on the monthly expense he is then operating under. Rent is one of the main items of expense, and this, together with lighting, heat, horse and clerk bill, he can approximate fairly close— so close, in fact, that he cannot go far astray.

The main point to emphasize is the necessity of adding to an estimate a certain percentage to cover the cost of operating the business. If the operating expenses are costing the contractor 10 per cent., and, making no allowance for this, he adds only 10 per cent. profit to his bill, he will find to his sorrow that he has performed the work without profit to himself. The following items will be found to include the chief operating expenses of a business:

Salary for the contractor.
Salary for foreman or superintendent.
Salary for bookkeeper and office help.
Shop and office rent.
Heat, light and power.
Uncollectable accounts.
Horse and wagon.
Telephone service.
Fire insurance.
Accident insurance for employees.
Loss of and wear on tools and plant.
Depreciation of furniture and fixtures.

It will be noticed that salary for the contractor is one of the items of operating expense, and the plumber should not forget for a minute that he should draw

a salary in addition to the profit from the business. In a business sense, as well as physically, the contractor and his business are separate and distinct items. He works for the business—not for himself—the same as he would for another firm or corporation, and the business must pay him the same as he would receive pay from any other business or concern. The profit arising from the business belongs to the business, and is in the nature of interest or dividends on the money invested. For example, the contractor can always command a salary for his services, and his money he can always put out at interest. If instead of working for another he prefers to combine his capital and services in a business, he must still draw his salary and interest on the money invested, or else he is operating at a loss. In determining what interest or profit he should make on his investment, he must remember that there are risks in business that are not encountered in the lending of money, and he must be reimbursed accordingly for his risks, knowledge and experience. Above all, he must not make the mistake of so many beginners of considering the profit his salary, and not allowing in the estimate for his services.

Allowing Profit.—In estimating, the question often arises, who is to profit by an estimator's or contractor's skill in design, economy of management, or closeness in buying. That is, suppose by rearranging fixtures an estimator saw where he could save $500 on an operation; should he figure on the work as planned and pocket the difference between the cost as originally laid out and as rearranged, or should he

estimate on the lower cost of the work and give to the owner the benefit of the saving?

There is no doubt but that if an estimator knew positively that he alone possessed sufficient skill to lay out the work so economically he would be perfectly justified in reaping the reward of merit and add to the profit account of his ledger the money saved by economical design. But right there is where the stumbling block lies. No man is so clever but others will be found who can show equal results, and the estimator who figures that he alone can lay out work economically will learn to his sorrow that other minds are equally bright and many of the choice contracts he hoped to carry off will go to rival shops. The only safe way is for an estimator to assume that his competitors are more clever than he is, and that in order to bid lower than the others he must find the very lowest cost he can satisfactorily do the work for; then, knowing the profit he is willing to do the work for, add it, and be satisfied whether he wins or loses. If he wins the profit is his. If he loses it is with the knowledge that he could not have taken off another dollar, so he has nothing to regret.

An estimator must not assume, however, that because he could not do the work cheaper the competitor who took it at a lower figure will lose money. Perhaps his skill in design is greater than yours, or he has some other method of procedure which enables him to do the work at a lower price. It is a good plan for an estimator when he has lost a contract for being too high, after he has figured his lowest, to inspect the work of his competitor from time to time as the installation progresses, to see if he can discover either

in design, workmanship or materials wherein the difference lies between his cost for a certain piece of work and his competitor's.

The percentage of profit to add to an estimate will depend greatly upon the character of the work. If the work is hazardous, where there is danger of losing considerable if everything does not go right, with but little chance for profit even under the most favorable circumstances, a percentage of from 50 to 60 per cent. would be considered a fair profit. For example, suppose a house sewer and water pipe were to be extended from the old work just inside a cellar wall to the sewer and water pipes in the street; that the soil to be excavated through was treacherous, likely to cave or give other trouble, and the street was a busy thoroughfare where accidents might happen due to having the street open. In such a case, if the cost of doing the work were $200, a profit of 50 per cent. or even 60 per cent. would not be excessive.

In ordinary work within buildings, however, no such percentage would secure the contract. Ordinarily, on all work in small cities, and on small installations in large cities, the allowance is from 15 to 20 per cent., while on large work in large cities, the allowance is from 8 to 10 per cent., according to the nature of the operation. For instance, in an operation where most of the cost is for fixtures and very little for labor, as is the case when the fixtures are well bunched together, an allowance of 8 per cent. might be all that an estimator could allow with a chance of winning. Take, for instance, a toilet-room, or a couple of toilet rooms, at an institution where

eighty fixtures, each averaging $35, are to be installed and where three workmen in thirty days can install the material. In such a case the cost of labor, which is the uncertain element in a plumbing estimate, bears but a slight proportion to the entire cost, and the signing of such a contract is almost like selling the goods on delivery. That being true, and there being no delay for the money, the contractor could better afford to do the work for a profit of 8 per cent. than he could other classes of work where the cost of labor is the chief item for a profit of 10 per cent. It may be well to remark, however, that 8 per cent. is too low an allowance to make only in exceptional cases where the circumstances warrant. Ordinarily from 15 to 20 per cent. in small cities and 8 to 10 per cent. in large cities are the profits estimated on, in addition to the operating costs, contingencies and other items which might swell the actual cost to the plumber. It might be added that 8, or even 10, per cent. is a very small profit to allow in a business as uncertain as the plumbing business. Unfortunately, however, in the larger cities that is the profit actually estimated on, and to allow a greater percentage would mean the loss of the contract.

Estimating from Incomplete Plans.—It is a simple enough matter to take off quantities from a set of drawings which are full and complete and are accompanied by detail drawings; but, when the drawings only show the locations of the various fixtures, as most plans of the present time do, an entirely different problem is presented.

To carefully estimate large operations when there are no plumbing plans, the only safe way is for the contractor to prepare a complete set for his own use. All he needs to do is to get a set of blue prints from the architect, tack over the floor plans pieces of tracing cloth and draw an outline of the various floors, showing the various partitions, toilet rooms and the location of the various fixtures. With this for a groundwork the various risers and vertical stacks of soil, water, vent and supply pipes should be marked on the several floors, and detail made showing the method of roughing-in the various toilet rooms. In short, he should make as full and complete a set of drawings as the architect would make, although they need not be so good. Having made a set of drawings, the quantities can be taken off in the same manner as when the finished drawings are furnished by the architect.

To the resourceful estimator the incomplete plans are most welcome, as they give him an opportunity to lay out his own work economically without his competitor having the advantage of as economical a layout. It is a case where the best designer should win, but is not so satisfactory or economical a method for the owner.

It is only large, complicated and important operations that need be laid out in full by the estimator. In small work a piece of white chalk and single lines marked on the blue print will enable the skillful estimator to scale the drawings and take off his quantities, while the chalk mark can be erased subsequently so competitors cannot benefit by the laying out of the system. Sometimes a pencil is used for

this purpose by an estimator, and all who use the plans after him know on just what runs he figured, and whether or not the design was economical, while those who are incompetent to lay out their own work benefit by the pencil marks left on the drawings.

Every plumber's office should be provided with a draughting board, instruments and materials, and those who wish to follow the business of estimator or become contractors should learn mechanical drawing, so they can lay out their own work on paper. The drawings being for their own use need not be finished productions, so long as they show clearly the work to be performed.

Instead of using tracing cloth and inking in the lines, the experienced estimator can use tracing paper and lay out his work thereon in pencil lines. Even more, he can lay out the work in single lines provided he is going to take off the quantities himself. If, however, one man in an office who is skilled in economical design is to lay out the work and another man take off the quantities from the drawings so prepared, the better plan is to make full and complete working details, then there is no possibility of the assistant going astray in taking off the items. If there is a handy boy in the office, the work of making plumbing plans and details will not be found burdensome, for the boy can do all of the drawing of walls, partitions, toilet rooms and other parts of the building which only require tracing, and all the chief estimator or designer will have to do is to lay in his pipes and make his details.

Sometimes plans which are turned out by an architect's office as full and complete are so complicated that an estimator sees where he can, by redrawing them and laying out the work, according to his own ideas, so simplify them that much money can be saved. When such is the case, he should receive permission from the architect to do so before going ahead with his estimate, for some architects absolutely refuse to permit any changes to be made from their layout, even though the work would be bettered thereby.

When permission is given an estimator to prepare his own layout of the plumbing work, when the architect's layout is unsatisfactory, whether to estimate on the original layout, and rearrange if the contract is secured, or estimate on the new layout, will depend, of course, on whether all the competitors are estimating on the original drawings, or likewise have had permission to arrange to suit themselves.

CHAPTER III

MAKING UP THE ESTIMATE

USE of Estimate Blanks.—The first act of an estimator when about to figure on a set of plans is to provide himself with a schedule of materials likely to be used, so that nothing can be overlooked when taking off quantities. It goes without saying that some form of list must be used by an estimator when taking off quantities, and if he depends on making up such a list as he proceeds with his work he not only is sure to omit some important items that will cut down the contractor's profit, or cause him to lose money on the work, but the additional time required to make up a list for one big operation would more than pay for the printing of one thousand blanks. Full and complete estimating blanks may be purchased at small cost from publishers, or the plumbing contractor can make up a list applicable to his own locality and the conditions that there obtain. He should not attempt to do much estimating, however, without a list of some kind to check his calculation. Indeed, every known means should be employed to safeguard the estimate by various forms of checks. The plumbing

for a large New York hotel was once awarded to a contractor who was well along with his work before he discovered that the soil pipe, fittings and calking lead for the work had been entirely overlooked. Such a state of affairs would have been impossible if an estimate blank had been used, for a glance would have shown the missing quantity.

Form of Estimate Blank.—An estimate blank, to be general in its scope and applicable to all parts of the country, would necessarily have items that would not be used under all conditions. For instance, for suburban work and country institutions sewage purification plants might have to be estimated on and, naturally, would have to be included in a complete estimate blank, even though such materials are not required in large cities. On the other hand, in large cities, where the subbasements of tall buildings are extended several stories below the level of the street sewer, sewage-ejectment apparatus must be provided, and such an item should form part of an estimate blank for city use. In the estimate blank shown in Fig. 33 all the various items likely to be required, either in city or country work, are included, and in making up an estimate blank from this form such items as will not be required in that locality may be omitted.

It will be noticed that the various fixture combinations are given complete. This simplifies the estimate blank by cutting down the number of items and reducing the possibility of error. Once the cost of a combination, together with its trimmings, has been ascertained, all that is necessary is to multiply

ESTIMATE BLANK

Estimate No..... Date.....

.....Architect .....Owner

Location and Description of Buildings .....

.....

Data Upon Which This Estimate is Based .....

.....

Drawings..... Specifications.....

Quantity	SIZE	DESCRIPTION	MATERIALS	ESTIMATED COST		ACTUAL COST	
			Water Closets, complete				
			Urinals, complete				
			Bath Tubs, complete				
			Lavatories, complete				
			Shower Baths, complete				
			Sitz or Foot Baths, complete				
			Bidets, complete				
			Slop Sinks, complete				
			Pantry Sinks, complete				
			Kitchen Sinks, complete				
			Drinking Fountains, complete				
			Hydrotherapeutic Apparatus				
			Swimming Pool, complete				
			Manicure Table and Basins				
			Operating Table				
			Laundry Trays, complete				
			Pumps				
			House Tank				
			Suction Tank				
			Hot-Water Tank				
			Water Heater				
			Sewage Ejectment Apparatus				
			Sewage Purification Plant				
			Soil Pipe and Fittings				
			Ferrules				
			Cleanouts				
			Calking Lead				
			Oakum				
			Pipe Hangers and Supports				
			Wrought Pipe and Fittings				
			Drainage Fittings				
			Solder Nipples				
			Brass Pipe and Fittings				
			Lead Pipe				
			Sheet Lead				
			Solder				
			Valves and Cocks				
			Permits and Taps				
			Excavating				
			Labor, Plumber and Helper				
			Carpenter Work				
			Mason Work				
			Gasoline and Oils				
			Board and Carfare				
			Incidentals				
			Insurance and Guarantees				
			Earthenware Pipe and Cement				
			Grease Traps				
			Stop-Cock Boxes and Hydrants				
			Water Meters				
			Filters				
			Temperature Regulators				
			Pressure Regulators				
			Marble or Slate				
			Bath-Room Trimmings				
			Freight and Drayage				
			Boxing and Crating				
			Lead Bends				
			Lead Traps				

Operating Expenses..... Net Cost $..... Profit $..... Estimate Submitted $.....

Fig. 33

that cost by the number of fixtures. When the various items of brackets, legs, cocks and wastes are estimated separately, however, there is a tendency to allow only one cock or bracket to a lavatory, or in other ways become confused and make an error. To further simplify the blank and keep down size to that of a sheet of legal-cap paper a number of items are only suggested. For instance, instead of enumerating windmills, hydraulic rams and other prime movers for pumping water, the whole list is summed up under the item "pumps." It is obvious that in estimating on operations where the specifications call for a windmill, the intelligent estimator would list it under the item of pumps, as that is the function of the windmill. Likewise, if a ram were to be used, the word pump in the schedule would call it to mind, as the means of moving the water, and the ram would be properly listed.

In the same way water heaters of whatever type are included under the one heading, the paragraph for description being sufficient to describe what kind and make of apparatus is required.

Bath-room fittings, such as soap cups, sponge holders, towel racks, mirrors, tumbler holders, medicine cabinets and scales are all included under the heading "Bath-room Trimmings," for the function of an estimate blank is not to provide an itemized list of everything entering into the make-up of a plumbing installation, but to serve as a memorandum so that no important item of cost can be overlooked. The blank here given has been used extensively and has given perfect satisfaction, combining, as it does, simplicity with thoroughness. Conditions differ in vari-

ous parts of the country, however, and in making up a list each contractor can alter by adding to or striking out any items he may see fit.

In filling out the blank it is well to place a check mark where blank spaces come in the cost column, to show that the items left blank have been considered and are not wanted.

In order to show the method of using the estimate blanks the example, or illustration, following on page 94 is appended as a guide.

It will be noticed that columns are provided on these blanks to show the estimated cost, also the actual cost of materials and labor. The information gained by this method of keeping account of how each item estimated on actually works out in practice is invaluable to a careful business man. As previously stated, profit should be made on every item entering into a plumbing installation and if the cost column shows that the actual cost was greater than the estimated cost the reason should be immediately ascertained and means adopted to prevent a repetition of the loss. Sometimes the cost of materials is advanced between the time of estimating or signing a contract and the ordering of the goods. Such a lesson should teach the contractor the wisdom of covering his contracts immediately by placing orders for all goods entering into the work, unless there should be a falling market. The goods can be ordered for future delivery and a subsequent raise in price will not cause a loss to the contractor. Oftentimes a loss can be traced to the fact that the latest quotation or discount was not properly entered in the cost book. Here, again

MATERIALS AND LABOR

Number	Size	Description	Material	Estimated Cost	Actual Cost
24	5½-feet	Standard Perfecto Plate, P-107....	Bath tubs	$ 940.50	$ 940.50
36	.....	Standard Delecto Plate, P-807.....	Water closets	1,710.00	1,710.00
1,000 feet	6-inch	Tar-coated, extra heavy.....	Soil pipe	350.00	328.50
2,600 feet	4-inch	Galvanized, extra strong.....	Wrought pipe	1,040.55	1,060.30
.....	.....	Labor of plumber and helper, 600 days.....	.....	3,000.00	2,800.00
One No. 36	Cap. 100 gals. hr.	Wilkes.....	Water heater	32.00	32.00

SOIL PIPE AND FITTINGS

SIZE IN INCHES	NUMBER OR FEET								
	2	3	4	5	6	7	8	9	10
Soil Pipe									
¼ Bends									
⅛, ⅙, and 1/12 Bends									
Y or TY Branches									
Traps									
Cleanouts									
Double Y or TY Fittings									
Crosses									
T Fittings									
Offsets									
Increasers									
Special Fittings									
Hooks and Hangers									
Reducers									
Vent Tees									
Single or Double Hubs									
Return Bends									
Vent Caps									

BRASS PIPE AND FITTINGS

SIZE IN INCHES	NUMBER OR FEET								
	⅜	½	⅝	1	1¼	1½	2	2½	3
Brass Fittings, Iron Pipe Sizes									
Brass Tubing, Iron Pipe Sizes									
Brass Tubing, Light									
Brass Fittings, Light									

COCKS AND VALVES

SIZE IN INCHES	NUMBER								
	⅜	½	⅝	1	1¼	1½	2	2½	3
Globe Valves									
Gate Valves									
Stop Cocks									
Stop and Waste Cocks									
Angle Valves									
Check Valves									
Safety Valves									

RECESSED DRAINAGE FITTINGS AND PIPE

SIZE IN INCHES	NUMBER OR FEET									
	1¼	1½	2	2½	3	4	5	6	7	8	10
90° Elbows											
45°, 22½°, 11¼°, and 5⅝°											
Y Branches											
Double Y Branches											
Double TY Fittings											
Three-way Elbows											
TY Branches											
Crosses											
Return Bends											
Increasers											
Traps											
Wrought Pipe											

WATER AND VENT FITTINGS

SIZE IN INCHES	NUMBER											
	⅛	¼	⅜	½	¾	1	1½	2	2½	3	4	4½	5
Wrought Pipe													
Elbows													
Tees													
Crosses													
Flange Unions													
R. and L. Couplings													
Unions													
Plugs and Caps													

Fig. 34

the estimate list serves as a check and points out the cause of loss, so a repetition can be avoided.

On the face side of the estimate blank only the total number of lead bends, ferrules, traps, feet of soil pipe, fittings and various other things are shown, but on the reverse side of the estimate blank, as shown in Fig. 34, are tables arranged so that the various quantities of different sizes of pipe, fittings, valves, etc., may be jotted down to complete the record.

In addition to the table of materials a space is provided for keeping a record of the various contractors who submitted estimates on the work, the amount of each bid, the contractor to whom the work was awarded and any remarks which would throw light on the award. It is not always possible, of course, to secure a record of competitor's bids, but when such information is obtainable the records make splendid data for use in future estimating.

CHAPTER IV

CALCULATING THE COST

LIST Price on Goods.—The real net prices at which goods are sold to those regularly engaged in the plumbing business are never or seldom stated in plumbing supply catalogues. Instead, certain prices are quoted which are much higher than the net prices, sometimes as much as one dollar being the list on materials that cost less than fifteen cents. To those regularly engaged in the plumbing business the various supply houses furnish discount sheets which show exactly how much may be deducted from the list price of every article shown or enumerated in the catalogues. These discount sheets, or quotations on certain things such as soil pipe and wrought pipe, are sent out from time to time by the supply houses to those on their mailing list, so that, by following them up closely, the contractor can keep posted at all times as to the cost of materials. There are two reasons for having a list price in catalogues and using a discount sheet to ascertain the real price. In the first place, if a catalogue of plumbing supplies falls into the hands of those who are not connected with the

business they can form no accurate idea from the prices listed of the real value of the goods. In the second place, prices are constantly fluctuating, and if the net prices were stated in the various catalogues the moment the price of any article listed in the catalogue either increased or decreased in value, the list price would be valueless, and when many changes had taken place a new catalogue would have to be compiled. As conditions now exist, instead of altering the catalogue, at certain intervals a new discount sheet, which seldom exceeds eight pages, is made out and sent to the various plumbers on the mailing list of a supply house, and during the interim between the issuing of discount sheet letters telling of changes in price are regularly sent out to the trade.

An example of a discount sheet is shown in Fig. 35.

Trade Discount.—Trade discounts are reductions made by manufacturers or jobbers to those regularly engaged in the plumbing business from the prices listed in their catalogues. Discounts are computed by the rules of percentage, the list price of goods being the base, and the discount the rate. When several discounts in series are allowed on certain goods—as, for instance, when a discount of 40, 10 and 5 is quoted on soil pipe—the first discount, that is, 40 per cent., is deducted from the list price; the second discount, that is, 10 per cent., is then deducted from the remainder, and the remainder so obtained is again lessened by subtracting from it 5 per cent. For instance, if a discount of 40, 10 and 5 be allowed on a bill of soil pipe, the list price of which amounts to $100, 40 per cent. would be deducted from this

DISCOUNT SHEET

APPLYING TO CATALOG "A"

ATLAS PLUMBING SUPPLY CO.

APRIL 10, 1910

Page	Discription of Materials	Discount Per Cent
1	Cast Iron Soil Pipe	20–10
2– 8	Cast Iron Soil Pipe Fittings	20–10–5
9	Wrought Pipe	30
10– 21	Recessed Drainage Fittings	30–7–2½
22– 30	Malleable Fittings	30–10–10
31– 38	Cast Iron Steam and Water Fittings	40
39– 68	Pipe Fitters' Tools	Prices net
69– 76	Brass Globe and Angle Valves, 2″ and smaller	15–5
	Brass Globe and Angle Valves, larger than 2″	10–10–5
77– 84	Railing Fittings	25
85– 93	Brass and Copper Pipe and Fittings	20–2½
94	Galvanized Range Boilers	15–10–10
95– 96	Copper Range Boilers	10
97–100	Compression Brass Goods	20
101–106	Fuller Brass Goods	20–5
107	Brass Ferrules and Cleanouts	30
108–112	Lead Traps and Bends	30–5–7½
113–145	Porcelain Enameled Baths	12½
146–152	Porcelain Baths	15
153–176	Closet Combinations	10
177–200	Lavatories	10–5–5
201–210	Porcelain Enameled Wash Trays	15
211–222	Porcelain Wash Trays	17½
223–230	Slate and Soapstone Laundry Trays	20
231–253	Porcelain Enameled Sinks	30
254–262	Porcelain Sinks	33⅓
263	Plain and Galvanized Black Iron Sinks	20

NOTE—This discount sheet supersedes all previous issues. All lists, discounts and questions are subject to change without notice. We will endeavor, however, from time to time, to advise our customers of variations in prices.

TERMS—Net cash 30 days, 2 per cent. discount 10 days. Boxing, crating and packages will be charged at manufacturers' rates.

Fig. 35

amount, leaving a balance of $60. From this balance 10 per cent., or $6, would be deducted, leaving a balance of $54, and 5 per cent. taken from $54 would leave a net price for the goods of $51.30. Instead, however, of deducting the three separate discounts the equivalent of the three can be ascertained and the equivalent discount deducted from the base. For instance, the equivalent of 40, 10 and 5 is .4870 and 100 x .4870 = $48.70, which subtracted from $100 leaves $51.30.

Instead of finding the discount on a purchase, then subtracting the discount from the list price, a quicker and easier way is to find the percentage remaining after the discount has been deducted and multiply the list price by the remaining percentage. The remaining percentage is always found by subtracting the rate or discount from 100.

For example, if the cost of a bill of soil pipe listed at $100 and subject to a discount of 40 per cent. be desired, find the remaining percentage by subtracting 40 from 100 = 60, and multiply this by the list cost, $100. Thus, $100 x .60 = $60 = net cost of pipe.

In Table XXII will be found the equivalent discounts of well-known and much-used series. In this table not only the equivalent discount of the series is given but also the figures by which to multiply to find the net cost of a bill of goods. For instance, if a bill of goods listed at $100 were subject to a discount of 40, 10 and 5, we have seen that the net cost of the goods would be $51.30. If you now multiply $100 by the factor .513 given in the table, you will see that the same net cost is obtained. The

table will be found very convenient when figuring discounts.

Series of discounts not found in the following table can be reduced to their equivalents by the following rule:

TABLE XXII

EQUIVALENT DISCOUNTS OF MUCH-USED SERIES

10 and 5 equals 14½%	off list price multiplied by .855	= net cost of goods
15 and 5 equals 19¼%	off list price multiplied by .807	= net cost of goods
20 and 5 equals 24%	off list price multiplied by .76	= net cost of goods
20 and 10 equals 28%	off list price multiplied by .72	= net cost of goods
25 and 5 equals 28¾%	off list price multiplied by .7125	= net cost of goods
25 and 10 equals 32½%	off list price multiplied by .675	= net cost of goods
25, 10, and 5 equals 35⅞%	off list price multiplied by .642	= net cost of goods
30 and 5 equals 33½%	off list price multiplied by .665	= net cost of goods
30 and 10 equals 37%	off list price multiplied by .63	= net cost of goods
30, 10, and 5 equals 40½%	off list price multiplied by .5986	= net cost of goods
35 and 5 equals 38½%	off list price multipiied by .6175	= net cost of goods
35 and 10 equals 41½%	off list price multiplied by .585	= net cost of goods
35, 10, and 5 equals 44¼%	off list price multiplied by .556	= net cost of goods
40 and 5 equals 43%	off list price multiplied by .57	= net cost of goods
40 and 10 equals 46%	off list price multiplied by .54	= net cost of goods
40 10, and 5 equals 48⅞%	off list price multiplied by .513	= net cost of goods
45 and 5 equals 47¾%	off list price multiplied by .5225	= net cost of goods
45 and 10 equals 50½%	off list price multiplied by .495	= net cost of goods
45, 10, and 5 equals 52$\frac{39}{40}$%	off list price multiplied by .47	= net cost of goods
50 and 5 equals 52½%	off list price multiplied by .475	= net cost of goods
50 and 10 equals 55%	off list price multiplied by .45	= net cost of goods
50, 10, and 5 equals 59¼%	off list price multiplied by .4075	= net cost of goods
55 and 5 equals 57¼ %	off list price multiplied by .4275	= net cost of goods
55 and 10 equals 59½%	off list price multiplied by .405	= net cost of goods
55, 10, and 5 equals 61½%	off list price multiplied by .385	= net cost of goods
60 and 5 equals 62%	off list price multiplied by .38	= net cost of goods
60 and 10 equals 64%	off list price multiplied by .36	= net cost of goods
60, 10, and 5 equals 65¼%	off list price multiplied by .3428	= net cost of goods
65 and 5 equals 66¼%	off list price multiplied by .3325	= net cost of goods
65 and 10 equals 68½%	off list price multiplied by .315	= net cost of goods
65, 10, and 5 equals 70$\frac{7}{10}$%	off list price multiplied by .293	= net cost of goods
70 and 5 equals 71½%	off list price multiplied by .285	= net cost of goods
70 and 10 equals 73%	off list price multiplied by .27	= net cost of goods
70, 10, and 5 equals 74$\frac{7}{20}$%	off list price multiplied by .2565	= net cost of goods

RULE:—To reduce a discount series to an equivalent single discount, subtract each rate of discount from 1, and multiply the remainders together. Subtract the product from 1 and the remainder will be the single discount.

EXAMPLE.—What single discount on the gross price is equivalent to a discount series of 60 per cent., 20 per cent. and 10 per cent.?

SOLUTION.—1 – .60 = .40; 1 – .20 = .80; 1 – .10 = .90; .40 x .80 x .90 = .288; 1 – .288 = .712, or 71 per cent.

It might be well to point out here that there is a difference between the amounts of discounts expressed for instance, on the one hand, as 40 and 10 and on the other as 50. For example, a $100 bill of goods subject to a discount of 50 per cent. would net $50, while the same bill of goods subject to a discount of 40 and 10 per cent. would cost $54. It will be seen, therefore, that the total discount of a series is always less than the total discount of the sum of all the discounts in a series would be.

Boxing, Crating and Cartage.—An item which must not be overlooked by the estimator when taking off his items or making up the quantities, is the charge made for boxing and crating goods for shipment. The prices charged for goods, as listed in catalogues, unless otherwise stated, are for the goods only in the warehouse of the jobber or manufacturer quoting the price. Before the goods can be shipped, however, they generally must be crated or boxed, and perhaps carted to the freight station.

The materials and labor for this work is charged for extra, in addition to the price of the goods, and must be estimated on or the goods will sometimes be sold at a loss. Generally, a list of conditions is printed in the catalogue of every supply house, stating under just what terms the goods are sold. Among these

conditions will generally be found a paragraph some thing like the following:

> **Boxing and Cartage.**—All boxing and crating is charged by us at cost. If packages are returned to us in good order, we will credit them, less freight and other expenses.
>
> Cartage will likewise be charged.

In addition to the charges for boxing, crating and drayage, made by the supply houses, the estimator might have other similar charges to make on his own end of the line. If a delivery wagon is kept by the contractor and the cost of horse, wagon and driver is included in the overhead expenses, no charge need be made in the estimate sheet for that service. If, however, extra outside help must be employed to do carting, that item should be entered on the estimate blank. In the case of boxing and crating, sometimes goods are sold out of stock and must be boxed or crated for shipment. In such cases, of course, a charge for that service is proper.

One bad feature of the charges for boxing and crating lies in the fact that there is no way for the contractor or estimator to know beforehand how much the charges will be; therefore, it is a difficult item to estimate on. Similar bills of goods sent out at different times from the same supply house, or sent out at the same time by different supply houses, will have various charges for boxing, no two of which are exactly alike. It would seem that if some system of charges were adopted, based on a percentage of the cost and according to the class of the ware, it would be better for the plumbers, even though the cost

would be greater, for the contractor would then have some data on which to base his costs for this part of the estimate.

Terms of Sale of Goods.—As previously stated, a list of conditions is usually printed in every catalogue, stating under what terms the goods are sold. The plumber should familiarize himself with these terms so he will know just what to expect under all conditions. The terms, while perhaps expressed differently in each catalogue, amount to about the same in all, and the following conditions, compiled from several catalogues, will serve as a model.

CONDITIONS

Catalogues and Prices.—This catalogue supersedes all previous editions; and all former lists, plate numbers, illustrations, discounts and quotations are hereby withdrawn. All prices herein quoted are subject to change without notice.

Orders and Deliveries.—All orders will be filled as soon as possible, but deliveries are contingent upon strikes, lockouts, accidents and other causes beyond our control. We will not be responsible for delay, or damage arising from delay, caused by such agencies.

Boxing and Crating.—Unless otherwise quoted on special orders, all boxing, crating and cartage will be charged by us at cost. If packages and crates are returned to us in good order we will credit them, less freight and all other expenses.

Packing and Routes.—Definite instruction as to mode of packing and by what route to ship, should be given with each order. When no special instructions are given, goods will be packed and shipped in the manner we deem most suitable.

Responsibility Regarding Shipments.—All goods are carefully packed and examined by experienced shippers to insure nothing but merchantable goods being sent out and we take every reasonable precaution against breakage in transit.

Our responsibility ceases, therefore, upon delivery of the goods in good condition to the transportation company at the dock or railroad station. If the carriers insist upon us signing a release or other document having reference to their reliability before they receive the goods, of course we must comply; that will not, however, affect the right of the party to whom they are consigned (who is deemed to be the real owner), to recover damages for any carelessness or neglect on the part of the carriers; but it should be distinctly understood that we, as senders, have no legal claim, after the goods are delivered to the carriers properly consigned, as the ownership has then passed from us to the purchaser.

Caution When Receiving Goods.—Before accepting goods from a transportation company, the purchaser should see that he gets each and every article called for in the bill of lading, and if shortage is shown should not receive the goods until the freight agent notes the shortage in writing on the freight bill, ***and signs it.*** In like manner, if the goods arrive in a damaged condition, the owner must not accept them until the freight agent notes the damage and the nature of the damage on the freight bill over his signature.

All goods leave our hands in good condition and if the purchaser accepts the shipment from the transportation company short of what is enumerated in the bill of lading or shipping receipt, or in a damaged condition, without taking the aforementioned precautions, the purchaser or consignee does so at his own risk.

Insurance.—When requested to do so, we procure insurance against marine risk on ocean shipments, or part rail and part water. We likewise can place insurance against breakage if the purchaser will make request therefor, with each order. By insuring against breakage the purchaser will be reimbursed for the loss in due course as the documents of facts supporting claim are sent to us and presented to the insurance company.

The purchaser is obliged, however, to use the same precaution as mentioned under the heading "CAUTION WHEN RECEIVING GOODS"; get the freight agent to note any damage or breakage, if such is apparent, on the freight bill, also,

when the purchaser unpacks the goods, which *should be done at once,* if he finds any breakage, he must immediately notify one of the insurance company's agents, who will then inspect the goods and ascertain the damage. The rate charged is according to the kind of goods, the distance, whether by water or part water and rail, and range from one to one and one-half per cent for domestic and three or five per cent for foreign shipments.

Claims for Shortage.—All goods are packed by experienced and careful packers, being double checked, and every precaution is taken to prevent errors. Furthermore, a packer's list of contents of each package is enclosed with the goods or mailed to the purchaser direct from the shipping department.

No general claims for shortage or errors will be considered unless they are made within ten days from the receipt of goods. If any shortage or errors are found, such must be reported to us at once, stating what items are missing and from what package. It has often occurred that we were charged with failing to have sent certain articles, when it was afterwards shown that such items had actually been shipped and that they had been overlooked when unpacking and were afterward found.

Claims for Defective Materials.—Brass and other metal goods are carefully inspected, but it is not always possible to detect imperfections in castings. Our guarantee is limited to the replacing with sound goods any that prove defective.

We are not responsible for damages beyond the price as charged and for no consequential expense or damage.

Returned Goods.—Goods cannot be returned to us without written consent. Any goods returned to us without our consent will not be credited the sender.

Countermanding Orders.—Once an order has been received, we will not acknowledge a countermand, unless we have been consulted in the matter and our permission obtained to said cancellation. Under no consideration can we accept a cancellation when goods are special or in course of preparation.

Freight and Drayage.—Prices on goods are sometimes quoted F. O. B. factory or supply house. By F. O. B. or f. o. b. is meant free on board or freight on board. That is, the seller of the goods will deliver them at the receiving station of the transportation company for the price agreed upon and free of all charges for boxing, carting or other like expenses. When the goods are not quoted F. O. B. however, boxing, crating and carting charges must be expected.

But with the goods delivered free on board, the estimator still has his freight bill to reckon, for he cannot fill out that item of expense without first ascertaining what the freight bill will amount to. No costs for shipping freight can be given here for the reason that the charges differ according to whether the haul is long or short, by water or rail, and what is equally important, according to the classification of the goods. In the carrying of freight the bulkiness of the goods has to be taken into consideration for the bulkier goods are, according to weight, the less can be carried in a car. For example, an ordinary freight car is limited in capacity to about 20 tons weight. If the goods to be shipped are pig lead, cast iron pipe, pig iron, lead pipe, wrought pipe or other like heavy but condensed materials, a freight car can carry its maximum load. If, however, it is oakum that is to be shipped, or crated bathtubs, the car would be filled before it contained a quarter of the weight it was capable of carrying. It stands to reason, therefore, that bath tubs or oakum could not be carried for as low a rate as could pig iron. Again, the risk run by the transportation company has to be considered in classifying goods, for, as they as com-

mon carriers are insurers of the goods they transport and there is greater risk in carrying bath tubs than pig iron, they must, naturally charge more for that class of goods. Transportation companies have printed schedules of rates and classification of goods showing just what the rate on each kind of article will be to any point.

Knowing this, the estimator has the key to the freight item of cost. Every plumber should have a list, compiled from the railroad company's schedule, showing just what classification each item entering into his business belongs in and the rate per hundred pounds for each class, from the point where his supplies are purchased, to his home town. Such a list could be made up something like the following:

CLASS A	CLASS B
30 cents per 100 weight, New York to Beverly	22 cents per 100 weight, New York to Beverly
BATH TUBS	CEMENT LAUNDRY TRAYS
LAVATORIES	SOAPSTONE LAUNDRY TRAYS
WATER CLOSETS	SLATE LAUNDRY TRAYS
SLOP SINKS	MARBLE
URINALS	STRUCTURAL GLASS
GAS FIXTURES	SLATE

CLASS C	CLASS D
18 cents per 100 weight, New York to Beverly	12 cents per 100 weight, New York to Beverly
SOIL PIPE	PIG LEAD
SOIL FITTINGS	LEAD PIPE
STEAM FITTINGS	SOLDER
SEWER PIPE	SHEET LEAD
VALVES	CEMENT
WROUGHT PIPE	CAST IRON BOILERS

The foregoing is printed merely as a suggestion to show the estimator a simple way to calculate the cost of freights. The class, rate and items in the various columns are purely imaginary and not to be depended upon. What the contractor should do is have a list compiled and verified by the local freight agent, then he is ready for figuring freight bills. For instance, suppose he is ordering 300 feet of 6 inch extra heavy soil pipe; 400 feet of 5 inch; 500 feet of 4 inch and 800 feet of 3 inch. From the table of soil pipe he will find that 6 inch weighs 20 pounds; 5 inch 17 pounds; 4 inch 13 pounds, and 3 inch 9½ pounds per lineal foot. Multiplying the various sizes by the weights, then adding the product he would find the sum of all the weights to be 26,900 pounds, and at 18 cents per hundred pounds, the rate of Class C to which soil pipe belongs, the freight would cost him forty-eight dollars and forty-two cents.

Some catalogues give the approximate weights when boxed or crated, of all the fixtures listed. It would be a great convenience if all catalogues furnished the same information. When, however, they do not, the information can be had by writing to the manufacturers; while the contractor can soon compile a lot of useful information for himself by noting the weights of different fixtures sent him, also the charges for boxing and crating, then form averages from them which he can use in calculating the weight of freight to be estimated on and the probable charge for boxing, packing and carting.

Another fact for the contractor to bear in mind is that the discount quoted by the supply house does not represent the plumbers' profit on the

goods. Indeed, it is much smaller, as the following will show: If 40 per cent. discount is given on a bill of goods, the plumber would get 40 cents off each dollar's purchase and pay 60 cents net. But if he sells that purchase again at the list price, he makes a profit of 60 X 1.68 = 1.00, or 68 per cent. on the transaction, because in this case the 40 cents taken off a dollar base is added to a 60 cent base.

Computing the Cost of Wages.—For convenience in estimating and making out payrolls Tables XXIII and XXIV are here introduced. These tables show the amount of wages to be paid per day, or week at eight, nine and ten hours per day when the scale or rate of wages are from 50 cents to $5 per day, and are from $3 to $20 per week.

Checking Plumbing Estimates.—No bid for plumbing work should ever be submitted without first checking up the estimate by some empirical rule to see if the amount figured is about what it should be. When a contractor has estimated and installed a number of operations similar in character—as, for instance, the work in apartment houses—he knows from his experience about what a like installation should amount to, and ought to tell offhand whether his estimate is right or wrong; but even under such conditions it is safer to check up the work by some simple method, such as given for checking labor by the day-per-fixture rule.

A simple method is to determine approximately what the labor and material per fixture will amount to, then multiply the number of fixtures in the building by that price. The product should agree approx-

TABLE XXIII

AMOUNT OF WAGES PER DAY

	Per Day	0.50	0.60	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00
TEN-HOUR DAY	½ hour	.03	.03	.04	.05	.06	.08	.09	.10	.11	.13	.14	.15	.16	.18	.19	.20	.21	23	.24	.25
	1 hour	.05	.06	.08	.10	.13	.15	.18	.20	.23	.25	.28	.30	.33	.35	.38	.40	.43	.45	.48	.50
	2 hours	.10	.12	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90	.95	1.00
	3 hours	.15	.18	.23	.30	.38	.45	.53	.60	.68	.75	.83	.90	.98	1.05	1.13	1.20	1.28	1.35	1.43	1.50
	4 hours	.20	.24	.30	.40	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00
	5 hours	.25	.30	.38	.50	.63	.75	.88	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88	2.00	2.13	2.25	2.38	2.50
	6 hours	.30	.36	.45	.60	.75	.90	1.05	1.20	1.35	1.50	1.65	1.80	1.95	2.10	2.25	2.40	2.55	2.70	2.85	3.00
	7 hours	.35	.42	.53	.70	.88	1.05	1.23	1.40	1.58	1.75	1.93	2.10	2.28	2.45	2.63	2.80	2.98	3.15	3.33	3.50
	8 hours	.40	.48	.60	.80	1.00	1.20	1.40	1.60	1.80	2.00	2.20	2.40	2.60	2.80	3.00	3.20	3.40	3.60	3.80	4.00
	9 hours	.45	.54	.68	.90	1.13	1.35	1.58	1.80	2.03	2.25	2.48	2.70	2.93	3.15	3.38	3.60	3.83	4.05	4.28	4.50
	10 hours	.50	.60	.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00
NINE-HOUR DAY	½ hour	.03	.03	.04	.06	.07	.08	.10	.11	.13	.14	.15	.17	.18	.19	.21	.22	.24	.25	.26	.28
	1 hour	.06	.07	.08	.11	.14	.17	.20	.22	.25	.28	.31	.33	.36	.39	.42	.45	.47	.50	.53	.56
	2 hours	.11	.13	.17	.22	.28	.33	.39	.44	.50	.56	.61	.67	.72	.78	.83	.89	.94	1.00	1.06	1.11
	3 hours	.17	.20	.25	.33	.42	.50	.58	.67	.75	.83	.92	1.00	1.08	1.17	1.25	1.33	1.42	1.50	1.58	1.67
	4 hours	.22	.27	.33	.44	.56	.67	.78	.89	1.00	1.11	1.22	1.33	1.44	1.56	1.67	1.78	1.89	2.00	2.11	2.22
	5 hours	.28	.33	.42	.56	.69	.83	.97	1.11	1.25	1.39	1.53	1.67	1.81	1.94	2.08	2.22	2.36	2.50	2.64	2.78
	6 hours	.33	.40	.50	.67	.83	1.00	1.17	1.33	1.50	1.67	1.83	2.00	2.17	2.33	2.50	2.67	2.83	3.00	3.17	3.33
	7 hours	.39	.47	.58	.78	.97	1.17	1.36	1.56	1.75	1.94	2.14	2.33	2.53	2.72	2.92	3.11	3.31	3.50	3.69	3.89
	8 hours	.44	.53	.67	.89	1.11	1.33	1.56	1.78	2.00	2.22	2.44	2.67	2.89	3.11	3.33	3.56	3.78	4.00	4.22	4.44
	9 hours	.50	.60	.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00
EIGHT-HOUR DAY	½ hour	.03	.04	.05	.06	.08	.10	.11	.13	.14	.16	.17	.19	.20	.22	.23	.25	.26	.28	.29	.31
	1 hour	.06	.08	.09	.13	.16	.19	.22	.25	.28	.31	.34	.38	.41	.44	.47	.50	.53	.56	.59	.63
	2 hours	.13	.15	.19	.25	.31	.38	.44	.50	.56	.63	.69	.75	.81	.88	.94	1.00	1.07	1.13	1.19	1 25
	3 hours	.19	.23	.28	.38	.47	.56	.66	.75	.84	.94	1.03	1.13	1.22	1.31	1.40	1.50	1.59	1.69	1.79	1.88
	4 hours	.25	.30	.38	.50	.63	.75	.88	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88	2.00	2.13	2.25	2.38	2.50
	5 hours	.31	.38	.47	.63	.78	.94	1.09	1.25	1.41	1.56	1.72	1.88	2.03	2.19	2.34	2.50	2.65	2.81	2 97	3.13
	6 hours	.38	.45	.56	.75	.94	1.13	1.31	1.50	1.69	1.88	2.06	2.25	2.44	2.63	2.82	3.00	3.19	3.38	3.57	3.75
	7 hours	.44	.53	.66	.88	1.09	1.31	1.53	1.75	1.97	2.19	2.41	2.63	2.84	3.06	3.28	3.50	3.72	3.94	4.16	4 38
	8 hours	.50	.60	.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00

imately with the estimate as calculated; if it does not, the estimator should go very carefully over his figures and items to see where the discrepancy lies. After estimating and installing a number of operations a contractor, by averaging the price per fixture he received for the various classes of buildings will arrive at the approximate costs per fixture, which he can then use as checks on similar buildings, until changes in the prices of materials force other factors to be determined. It is a very simple matter to determine the approximate cost per fixture. For instance, if an apartment house of forty bath rooms and kitchens were to be estimated upon, and the class of goods used were to be such that the kitchen sinks cost $3 each, the laundry trays $20 per set, the water closet $25, bath tub $36, lavatory $20, and if two days were allowed per fixture for the labor, roughing-in and finishing, labor for plumber and helper costing $5 per day, while the soil pipe, lead pipe, wrought pipe, cocks, valves and other materials averaged about $5 per fixture—then the six fixtures in bath room and kitchen, there being two laundry trays and each compartment representing a fixture, would average $33.16 each. Knowing the cost per fixture and the number of fixtures in the building, which would be 6x40 = 240, the cost of the operation could be approximately determined by multiplying 240 by $33.16 = $7,958.40. If the cost of the operation, as determined by the itemized estimate, were to run several hundred dollars either above or below this approximate cost, the estimator should satisfy himself that no mistake has been made in his qualities or calculations.

TABLE XXIV

AMOUNT OF WAGES PER WEEK

Per Week of Six Days	3.00	3.50	4.00	4.50	5.00	7.00	7.50	8.00	9.00	10.50	13.50	15.00	16.50	19.50	21.00	22.50	27.00
1 day	.50	.58	.67	.75	.83	1.17	1.25	1.33	1.50	1.75	2.25	2.50	2.75	3.25	3.50	3.75	4.50
2 days	1.00	1.17	1.33	1.50	1.67	2.33	2.50	2.67	3.00	3.50	4.50	5.00	5.50	6.50	7.00	7.50	9.00
3 days	1.50	1.75	2.00	2.25	2.50	3.50	3.75	4.00	4.50	5.25	6.75	7.50	8.25	9.75	10.50	11.25	13.50
4 days	2.00	2.33	2.67	3.00	3.33	4.67	5.00	5.33	6.00	7.00	9.00	10.00	11.00	13.00	14.00	15.00	18.00
5 days	2.50	2.92	3.33	3.75	4.17	5.83	6.25	6.67	7.50	8.75	11.25	12.50	13.75	16.25	17.50	18.75	22.50
6 days	3.00	3.50	4.00	4.50	5.00	7.00	7.50	8.00	9.00	10.50	13.50	15.00	16.50	19.50	21.00	22.50	27.00
7 days	3.50	4.08	4.67	5.25	5.83	8.17	8.75	9.33	10.50	12.25	15.75	17.50	18.75	22.75	24.50	26.25	31.50
8 days	4.00	4.67	5.33	6.00	6.67	9.33	10.00	10.67	12.00	14.00	18.00	20.00	22.00	26.00	28.00	30.00	36.00
9 days	4.50	5.25	6.00	6.75	7.50	10.50	11.25	12.00	13.50	15.75	20.25	22.50	24.75	29.25	31.50	33.75	40.50
10 days	5.00	5.83	6.67	7.50	8.33	11.67	12.50	13.33	15.00	17.50	22.50	25.00	27.50	32.50	35.00	37.50	45.00
11 days	5.50	6.42	7.33	8.25	9.17	12.83	13.75	14.67	16.50	19.25	24.75	27.50	30.25	35.75	38.50	41.25	49.50
12 days	6.00	7.00	8.00	9.00	10.00	14.00	15.00	16.00	18.00	21.00	27.00	30.00	33.00	39.00	42.00	45.00	54.00
13 days	6.50	7.58	8.67	9.75	10.83	15.17	16.25	17.33	19.50	22.75	29.25	32.50	35.75	42.25	45.50	48.75	58.50
14 days	7.00	8.17	9.33	10.50	11.67	16.33	17.50	18.67	21.00	24.50	31.50	35.00	38.50	45.50	49.00	52.50	63.00
15 days	7.50	8.75	10.00	11.25	12.50	17.50	18.75	20.00	22.50	26.25	33.75	37.50	41.25	48.75	52.50	56.25	67.50
16 days	8.00	9.33	10.67	12.00	13.33	18.67	20.00	21.33	24.00	28.00	36.00	40.00	44.00	52.00	56.00	60.00	72.00
17 days	8.50	9.92	11.33	12.75	14.17	19.83	21.25	22.67	25.50	29.75	38.25	42.50	46.75	55.25	59.50	63.75	76.50
18 days	9.00	10.50	12.00	13.50	15.00	21.00	22.50	24.00	27.00	31.50	40.50	45.00	49.50	58.50	63.00	67.50	81.00
19 days	9.50	11.08	12.67	14.25	15.83	22.17	23.75	25.33	28.50	33.25	42.75	47.50	52.25	61.75	66.50	71.25	85.50
20 days	10.00	11.67	13.33	15.00	16.67	23.33	25.00	26.67	30.00	35.00	45.00	50.00	55.00	65.00	70.00	75.00	90.00
21 days	10.50	12.25	14.00	15.75	17.50	24.50	26.25	28.00	31.50	36.75	47.25	52.50	57.75	68.25	73.50	78.75	94.50
22 days	11.00	12.83	14.67	16.50	18.33	25.67	27.50	29.33	33.00	38.50	49.50	55.00	60.50	71.50	77.00	82.50	99.00
23 days	11.50	13.42	15.33	17.25	19.17	26.83	28.75	30.67	34.50	40.25	51.75	57.50	63.25	74.75	80.50	86.25	103.50
24 days	12.00	14.00	16.00	18.00	20.00	28.00	30.00	32.00	36.00	42.00	54.00	60.00	66.00	78.00	84.00	90.00	108.00
25 days	12.50	14.58	16.67	18.75	20.83	29.17	31.25	33.33	37.50	43.75	56.25	62.50	68.75	81.25	87.50	93.75	112.50
26 days	13.00	15.17	17.33	19.50	21.67	30.33	32.50	34.67	39.00	45.50	58.50	65.00	71.50	84.50	91.00	97.50	117.00
27 days	13.50	15.75	18.00	20.25	22.50	31.50	33.75	36.00	40.50	47.25	60.75	67.50	74.25	87.75	94.50	101.25	121.50
28 days	14.00	16.33	18.67	21.00	23.33	32.67	35.00	37.33	42.00	49.00	63.00	70.00	77.00	91.00	98.00	105.00	126.00
29 days	14.50	16.92	19.33	21.75	24.17	33.83	36.25	38.67	43.50	50.75	65.25	72.50	79.75	94.25	101.50	108.75	130.50
30 days	15.00	17.50	20.00	22.50	25.00	35.00	37.50	40.00	45.00	52.50	67.50	75.00	82.50	97.50	105.00	112.50	135.00
31 days	15.50	18.08	20.67	23.25	25.83	36.17	38.75	41.33	46.50	54.25	69.75	77.50	85.25	100.75	108.50	116.25	139.50
Per Day at Seven Days per Week	.43	.50	.59	.64	.71	1.00	1.07	1.14	1.29	1.50	1.93	2.14	2.36	2.79	3.00	3.21	3.86

Cost Book.—The plumbing contractor should keep a cost book, properly indexed, in which to note the latest quotations on materials received by him. Plumbing supply houses send out from time to time new discount sheets; letters telling of changes in discount from the last quoted, and notices that new fixtures or goods have been added to the line carried, or that the manufacture of some fixture listed has been discontinued; as soon as these various notices are received they should be immediately noted in their proper places. If the manufacture of certain goods is discontinued, that information should be posted in the catalogue where the goods are illustrated and described. If new fixtures are added to a manufacturer's line the illustrations and descriptions should be entered in the catalogue and properly indexed so that they can be easily located. Should the list price on any goods be altered the list price in the catalogue should be changed to conform to the new quotation. If these precautions are not taken the contractor will find to his cost that he is estimating on old prices, and either failing to secure the work or contracting for it at a loss, according to the condition of the market since he last corrected his catalogues. Again, he might be estimating on fixtures which are no longer made, or, when limited for time, guessing at the cost of some new fixture he knows nothing of because he has not properly entered it in its proper catalogue.

The cost book is solely for the purpose of keeping account of the latest discounts quoted, which should be entered as soon as received. Putting off until some future time is liable to be putting off forever, and depending on memory is extremely uncertain.

The list and discount on stock goods, such as soil pipe and fittings and wrought pipe and fittings, should be carried in mind, but never depended upon when estimating a large operation.

Oftentimes, while inspecting the work in a new installation, the contractor is called upon to quote a price on an extra sink, water closet or lavatory, and if he has the cost of all material required in his mind, or a memorandum of prices in a pocketbook, he can quote a price on the spot and probably close the order immediately, while if time were required to look up prices, the owner might change his mind.

Getting Jobbers' Prices on Lists of Goods.—When figuring on a large installation containing a great many fixtures and correspondingly large quantities of pipe fittings and brass goods, the plumber will find that he can get a much better price on the goods by making out a complete list of everything that will be required and submitting it to a couple of jobbing houses for a price. In compiling a discount sheet, the supply houses have to take into consideration the fact that most of the orders sent in will be small ones, two or three fixtures at a time, a dozen or so faucets, and other materials in proportion; consequently, the prices quoted in the discount are based on such quantities. When therefore a large order is under consideration, the supply houses can shade their prices, just as the plumbing contractor will figure a lower percentage of profit for installing the work in a ten thousand dollar contract than he would in an ordinary dwelling where the contract price did not run over three hundred dollars. Fur-

ther, when the order for certain supplies such as fixtures and specialties is an unusually large one, the jobbers will submit a list of the goods to the several manufacturers from which they purchase, and as the principle of quoting a better price on large orders than on small ones holds good all along the line, the jobbers will get a better price from the manufacturers, consequently can quote a better one to the plumber.

This principle of buying in large quantities holds true when located remote from supply houses and carrying goods in stock, by making out a list of all the goods likely to be needed in a year or six months, and ordering them at one time after first having received prices from the jobbers, the plumber who can afford to do so will save considerable in the cost, in freight, drayage and in handling. The caution might well be sounded again, though, that unless the plumber can afford to buy in large quantities, and allow his money to be tied up in stock, it is better not to do so. A well selected stock of smaller size will serve his purpose just as well, and leave him his invested capital as real working capital, when it is most needed.

PART II

CONTRACTS

CHAPTER V

BUSINESS OF CONTRACTING

STARTING in Business.—It is the ambition of a large percentage of the journeymen plumbers to engage in business for themselves, but most of them are unfortunate in possessing no business training or experience. For their benefit some of the principles underlying the successful conduct of a business are here given.

The first qualification for a successful business career is a thorough knowledge of the plumbing business. It is not so necessary to be a good workman, for the contractor will not be called upon to install the work he contracts for. He should, though, be well versed in the principles and practice of the calling, so he will be quite capable of intelligently estimating on and laying out the work for his journeymen to install. The theoretical part of plumbing can be

acquired by a thorough study of the subject, and there are plenty of good books on the market, so the prospective business man can teach himself with their aid No one book should be considered sufficient for the student, but he should read everything printed pertaining to his calling, so he will know the views of the conflicting authorities. The main thing to impress on his mind is that he should study, and through study make himself proficient in his calling.

Not only should the young business man have a good library of plumbing books, but he will find it to his business interest to subscribe for one or more of the trade papers. New fittings, fixtures and devices are constantly being put on the market, and as soon as they are offered to the trade the devices are advertised in the trade papers. In addition to this, most of the manufacturers of plumbers' specialties list and illustrate their goods there, so that trade papers are almost as good as a plumbing supply directory. Furthermore, the papers contain in each issue one or more technical articles which will repay the reading.

When fully proficient in the technical branch of the calling it would be decidedly to the student's interest to take a night course in some good business college, taking up bookkeeping, commercial law and business forms. One winter of close application will qualify him sufficiently so he can keep a fair set of books and will not be wholly ignorant of business usages. It is necessary for the successful conducting of a business that a set of books be kept, for without it no business man can tell how he stands with rela-

tion to his business, nor can he tell where his business leaks.

In addition to these facts, the bankruptcy laws of the United States require that books be kept, showing all the petitioner's business transactions, if he is to be extended the privilege of the bankruptcy laws; and, while the young business man does not look forward to an unsuccessful business career ending in the bankruptcy court, still he must be prepared for that emergency should it arise.

If he does not take a course in a business college, either for lack of time or for other reasons, he should, at least, provide himself with a copy of "Bookkeeping for the Plumber," by George W. Ryan, and study as well as apply the text.

In the new venture the journeyman plumber is about to lay down the tools of trade and enter into a new calling—that of a business man—where he will be pitted against men trained to commercial pursuits from childhood. In order that he be able to hold his own with them the young business man should study not only the technical part of his calling and bookkeeping, but he should also interest himself in business law, particularly the law of contracts and banking, and likewise should study advertising and salesmanship, for on his knowledge of these subjects, either natural or acquired, will depend to a great extent, the success or failure of his business. The journeyman who enters business must be prepared for hard knocks. Starting a business is not all it looks to the uninitiated, and many a heartache will be experienced before the business is finally established on a firm footing or meets with disaster. In order to

succeed the journeyman must have courage, and courage of a high order, not the common physical courage of combat. He must have confidence in himself, a firm determination to succeed, and combined with these qualities he must possess the continuity to remain in business at least one year, even at a loss.

The percentage of businesses that make a profit during the first year of their existence is so very small that the statement may be broadly made that the business which pays expenses the first year is in a prosperous condition. This is what must be expected. Unless the young business man possesses a large acquaintance among architects who have confidence in his ability and integrity it will be a long and tedious pull getting the entree to their offices, with the privilege of estimating on work for them. So many "skin" contractors are at large these days that people who have the letting of work are not wholly satisfied that one is financially responsible, but want further to know whether he is inclined to do good work and live up to the terms of his contract, and, as the young business man has no references to offer when starting in business, his greatest task will be to secure recognition. If this much is accomplished during the first year suitable progress has been attained. In the meanwhile, overhead expenses are eating out his capital, so that in the majority of cases the little work secured by the young business man is not enough to keep his books from showing a loss at the end of the year.

Business Capital.—The first requisite of business success is sufficient capital to carry on the business

when it is established. The amount of working capital that will be required depends so much on many different conditions that no set amount can be stated as necessary, although the statement can safely be made that it is not likely that too much capital will be invested. It is not likely that expenses will be more than paid the first year, while, on the other hand, considerable money will be invested in furniture and fixtures, tools and apparatus, stock and other expenses, so that more than the amount necessary to run a moderate business for one year without returns would be advisable.

If the contractor is successful in securing paying contracts during the first year, and is energetic in following up and collecting outstanding accounts, a smaller working capital can be made to answer than when conditions are reversed. Again, the distance away from supply houses will have an important bearing on the amount of capital required. In the large cities, where supplies are convenient and but little money need be tied up in stock, most of the cash is clean working capital. On the other hand, when located some distance away from the base of supplies, after the regular stock has been purchased sufficient cash should still remain to defray all operating expenses for one year and leave besides a working fund to defray the cost of labor and materials for any contracts that might be signed.

As a basis for estimating, however, it might be stated that a cash capital of 10 per cent. of the yearly volume of work that will be done should prove sufficient after the first year is over and business actually being transacted. For instance, if the yearly volume

of work amounts to $20,000, $2,000 working capital would be sufficient for a careful business man, although a greater amount would be desirable. The young contractor should be warned against the error of contracting for more work than he has capital to install. More young contractors fail for this reason than for any other. Never sign contracts for a greater amount of work than your ready working capital is 10 per cent. of unless the work is of such a nature that it, or some of it, can be turned over quickly, inside of thirty or sixty days, and payment secured, thus completing the contract. As work ordinarily runs, however, more or less capital is tied up in each operation in the form of materials and labor, and if too many operations are under way at once there will be no working capital left with which to pay for labor and the current monthly accounts.

Opening a Line of Credit.—No matter how great the amount of capital invested in a business it would not be sufficient if the contractor had to pay cash for all of his purchases. Even though it were sufficient, paying cash for all goods bought is inconvenient and attended with delays that would go far toward cutting down the profit on a contract. For these reasons, as soon as a man starts in business he should take steps to open a line of credit with the supply houses with which he wishes to deal. No better way of going about this operation can be found than to submit a written statement of the resources and liabilities of the individual or firm, together with a list and addresses of people with whom they have had business dealings, and of others who have known them for

a long time and can vouch for their honesty and ability.

In deciding as to the amount of credit to extend to a new concern a supply house will consider not only their honesty and present ability to pay, but likewise their chances of succeeding in business. In their judgment of the likelihood of success or failure they will be guided to a great extent by the technical and business knowledge of the applicant, his sobriety, energy and general manly qualities. These qualities are exhibited to an intelligent credit man by the manner in which the applicant asks to open an account or secure goods on credit.

If, when duly engaged in business, it becomes desirable to purchase goods from a concern with which there has been no prior business dealings, an order may be sent in, but accompanying the order should be a statement of the business, together with a reference to those concerns from whom goods have already been purchased. Most supply houses would sooner have the statement of another supply house as to the way an applicant's bills have been paid than any other kind of information that can be furnished. It is of little interest to them that the applicant has a fairly large cash balance, but is slow in the payment of his bills, taking sixty to ninety days before remitting, and then only after having been repeatedly dunned. They would sooner do business with a contractor who has less working capital but, through being energetic in the conducting of his business, is able to turn the money over faster and is always prompt in the payment of his bills, even to the point of discounting them. Do not be afraid to give a frank, honest state-

ment of your present worth, and so conduct your business accounts that every person from whom you purchase goods will not only be anxious for a continuation of your trade, but will give a good account of you to whoever may apply for information.

Before you have been long in business, in fact, as soon as you try to open an account with a supply house, you will be asked by the mercantile agencies to supply them with a statement of your financial resources and the names and addresses of references. Their applications should be as frankly and as honestly complied with as the statements to the supply houses, although, for special reasons, there might be some questions of the mercantile agencies which you do not feel called upon to answer, while at the same time not withholding the information from the supply houses.

It might be well to add that it is better to take up the matter immediately with the supply houses and learn what line of credit they will extend to you, and not wait until a bill of goods is wanted, then have to wait while they look you up and decide as to your responsibility. It is one of the preliminaries of business that should be settled definitely and immediately, so you will know just what to figure on in the way of credit. Of course, the credit originally extended will not be as large as will afterward be granted if the individual or concern is successful with the business and prompt in the payment of bills, and as credit is the backbone of any business it should be guarded zealously.

Extending Credit to Others.—No less important than the securing of credit is the extending of credit

to others. The young business man will soon discover that all orders brought to his shop do not represent profit, and that the least desirable customers, those who are refused credit elsewhere, are the first to discover his location and overwhelm him with orders, without even asking the cost. Before doing work for a new patron, however, the contractor should exercise the same caution that supply houses exercise toward him. In this commercial age responsible men do not resent inquiring as to their responsibility, and it is better to lose the work of irresponsible men.

When an order for a small amount of work is left by some one living in the neighborhood who is unknown to the contractor, he can easily and quickly ascertain the individual's responsibility by inquiring among the shop keepers in that locality. If the man is reputed to not pay his bills do not hesitate to demand payment in advance, security, or refuse to do the work. The time lost in superintending such work and subsequently trying to collect the bills would go a long way toward securing paying work.

In the large cities speculative builders of little or no responsibility often have the appearance of material worth and prosperity by reason of the fact that they are building a row of houses. The young business man will do well not to be carried away by appearances in such a case, but to look well into the responsibility and promptness of all such builders. Indeed, before signing a contract for any work the plumber should first satisfy himself that the other party to the contract is not only able but is likewise willing and anxious to pay all debts contracted. He cannot afford to risk the chances of business success

by doing work for people of questionable responsibility, for no matter how much he might desire to take a chance on the contract he should remember that he owes certain consideration to his creditors, and has no right to risk their goods.

Carrying Stock.—What stock to carry, and the amount, will be questions that will arise in the mind of every plumber who contemplates engaging in the plumbing business, and they are not easily answered, for each case is a law unto itself. It may be stated, however, that when the place of business will be located in a large city convenient to supply houses, only such stock should be carried as is absolutely necessary for the jobbing and repair trade. The use of money is of value, and when goods can be ordered one day and delivered the next there is no reason for carrying them in stock. The money that would otherwise be tied up in material can remain to the contractor's credit in a bank or trust company, drawing at least 3 per cent. interest, and he saves the extra cost of drayage and handling twice, besides the rent of a place for storing the goods. When, on the other hand, the plumber's business is located far from supply centers the better plan is to carry a full and complete line of everything required in that locality. By this means he will save much of his workmen's time on operations by having everything for them so that they will not be delayed or inconvenienced by lack of materials, and, furthermore, he will save on the purchase of goods, for if he buys pipe, for instance, in carload lots, he will secure a better price, will receive a freight allowance and will save on the time of hand-

ling and carting the material. Stock goods are the only materials, however, that should be carried. Specialties for which there is little demand need not be purchased until ordered. Again, if doing a heating business, while advisable to carry one or more boilers in stock, still, it would be foolish to lay in an extensive line, for the sizes required vary so that it is better to order a boiler of the right capacity when needed.

In ordering soil pipe and fittings for stock it should be borne in mind that a certain percentage of it should be double-hub pipe, and that unequal numbers of the different kinds of fittings will be used. The proportion of the various fittings likely to be required for the work as done in that locality should be studied out and the goods ordered accordingly. The main error to guard against is the laying in of a large stock of dead material—that is, material which there is little or no use for.

Place of Business.—When ready to make a start the prospective business man is often at a loss where to establish his business. If he has been brought up in one town, where he is well and favorably known, he no doubt will locate there. If, on the other hand, he has been a traveling journeyman looking for a place to locate, his feelings will be divided between some small home town, where competition is not keen and where he would like to live, and a large commercial center where business is brisk but competition keen. The deciding of the question is so much a personal matter that no course can be laid down here to guide the individual. If he believes that a pleasant

home life with less income is preferable he will locate in the home town. If, on the contrary, he has no choice, so far as living is concerned, it is better to seek for his fortune in the large city where there is plenty of business. If he locates in a conservative town, where very little in his line is being done, he knows beforehand that his chances of a marked success are slight. If, however, he sets up in business in a large city where there is plenty of work, according to the doctrines of chance he will get his share, and if a good business man, well posted on his calling, he will be able to make a striking success of his venture, a condition that would be impossible in a small place.

Having decided on the city in which to locate, the next consideration is to determine on a locality and here again the one most interested must decide for himself. A few suggestions, however, will not be amiss. If the place of location is a small or moderate sized city the most advisable course to pursue would be to select a well-located, brightly lighted store on one of the principal thoroughfares, where his presence would soon be noted by everybody in town, and thus become established.

The same policy might be followed with success in large cities if repair work and overhauling are to be made a specialty. In such case he would want a location either on a principal business street or a prominent location on one of the business streets of a residence section. It is poor policy to economize by renting an alley place of business, or opening a basement shop to save rent. Such places are not inviting, and women who have the deciding of such matters, do not care

to enter a dirty or inaccessible place of business to leave orders.

If the plumber intends doing only a contracting business, devoting all his energies to the securing of new work, a good plan is to open an office in a building where a number of architects and builders are colonized, and in that manner become one of them. In such a case he will need a warehouse for the storage of goods and general workshop for his men when getting out material in the shop. If he opens an office among architects and builders he should fit it up in a businesslike way, so as to impress those who enter with the stability and permanence of the establishment. Nothing so prejudices a person against a business as an office which has a fly-by-night appearance, as though the tenant was here today and nobody knows where tomorrow. Fit up the office in a substantial manner with a heavy desk, safe, typewriter, clerk and rug. Then hang suitable framed pictures on the walls, suggestive of the business of the occupant, or showing photographs of large work installed. Try to impress those who enter, by the appearance of the office, that the business has been established and successfully running for years and will continue to run for centuries. There is nothing which impresses people like success.

Store and Window Display.—If the plumbing contractor rents a store for his place of business he wants to get out of it all the value that is possible, and no better means can be found to that end than to put in a good display of plumbing fixtures, both in the store proper and in the show window.

An attractive window display calls attention to the fact that a plumber's place of business is located at that number, and if a workman is needed in a hurry the place of business will be immediately remembered while less pretentious places will be forgotten. Further, exhibiting attractive fixtures in an artistic manner creates a desire in those who observe to possess like conveniences in their homes, and the first part of a sale, the creating of a desire and attracting to the place of business, is accomplished.

If people who contemplate improvements are impressed with the display they will call at the store for further information, and, while they may not purchase at that time, if the impression made is good they will bear the place in mind when ready to buy and will talk of it to their friends in the meantime.

In order to interest these prospective purchasers the shop must be made attractive inside so that the goods will show off to the best advantage. Bear in mind that a jeweler never shows an uncut diamond to a prospective purchaser, expecting to sell it to him by describing how it will look when cut. On the contrary, he cuts the diamond and places it on a background of the right kind of cloth, or shows it off in an attractive setting. They know, as the plumber must learn, that most people lack imagination, and, to sell them, they must be shown the goods as they will actually look when finished, not as they are in the rough, with a verbal description of how they will look when finished. It will pay the plumber to fit up two or more bath rooms complete, with tiled walls and floors and decorated ceilings, then place in position all the necessary bath-room accessories, such as

towel racks, cup holders, scales and other articles that add to the attractiveness of a display. Seeing these bath rooms, the desire to possess is irresistible to most women, and it is the women who have the purchasing of supplies and furnishings for the household.

The aim, then, should be to attract the women, and most assuredly a lot of old junk, obsolete pan closets, defective joints and bar solder piled in the window will not attract—it will repel. And not only will it repel the women, but likewise the men. It is all very well for the plumber to be interested in curiosities of workmanship he has taken out of old buildings, but those things are not understood by those outside of the trade and do not appeal to them. A clothier might be interested and amused by the ragged clothes of a beggar and consider them the most ragged and interesting he had ever seen, but, if he were to fill his show windows full of such curiosities, together with all kinds of misfit and out-of-style clothes, he would soon drive away all his trade. Show windows are supposed to exhibit what the shopman has for sale, and if he exhibits old clothes or old pipe joints the public will look upon the place as a curiosity shop or junk shop. The plumber-merchant can well copy after the merchant-clothier, and whatever methods the latter finds valuable for attracting trade may well be adopted by the plumbing contractor. In the show windows of clothiers are displayed the best of his stock, and he keeps a high-salaried decorator or window trimmer to do nothing else but make the window attractive The plumbing contractor should, therefore, do likewise so far as making his show window and shop attractive and appealing.

The value of artificial light in making show windows bright and attractive after dark should not be overlooked. There are many people go down town at night who cannot easily get away during the daytime, and if show windows are not brilliantly lighted this class of people will never see the display, and part of the advertising value of a show window will be lost. Further, the streets are not so crowded with busy people in the evening and those who are out have more leisure to look about and examine the various attractive show windows. Lights need not be kept burning in the shop and show windows later than 10.30 P. M., and arrangements can easily be made with the watchman on that beat, the janitor of the building or some other person to turn off the lights at that hour.

Advertising.—No person can be really successful in business without advertising. By the term advertising is not meant, necessarily, the paying for space in the local papers and in street cars—although those are two of the best publicity mediums—but the keeping of one's business favorably before the public. In the term "favorably" lies the secret of successful advertising. The announcing of your wares to the public is a business matter, and those who try to make a joke of their advertising and a cartoon of their copy by the same token make a joke of their business and a caricature of a business man of themselves. Selling goods is a serious matter and what is required in a plumber's advertisement is a quiet, dignified, appealing statement which awakens a desire to possess the articles offered for sale. That

being true, it follows as a natural corollary that a scare advertisement, picturing the danger in the deadly but mythical sewer gas, and the illness and death attendant upon those who have improperly constructed drainage systems, does not only appeal to the public and make them wish to have a complete plumbing installation, but actually frightens those who contemplate such a course, and causes them to pause and consider if the comfort and convenience are worth the danger they run.

In advertising do not pay for valuable space and, because it is filled with something humorous, loathsome or catchy, imagine it is good copy. Advertising is salesmanship, and if you wish to reach and influence your public it will be necessary to talk to them through the medium of your paid space, the same as if you were interviewing them separately in their offices. In advertising you have something to say. Tell it and then stop, so the story you have told can sink and stick in the reader's memory

The best advice about advertising that could be given to the prospective business man is to purchase a good book on the subject, or borrow one from the library, and study its principles thoroughly until perfectly familiar with the requirements of space, copy, display and mediums For the benefit of those who cannot get such a book a few helpful suggestions will here be given.

Preparation of Advertising Copy.—In the preparation of advertising copy do not be satisfied with a mere business card, containing the name, business and location, but tell a story in each issue of the paper.

The copy need not be changed for each issue, or, perhaps, oftener than once a week, but it should be changed from time to time and should be seasonable. That is, in the spring of the year it would be seasonable to advertise that boilers and heating plants are put in condition so they will not deteriorate by rust during the summer. In the autumn it would be seasonable to suggest putting heating plants in working order for cold weather; but an advertisement in midsummer urging repairs to the heating plant would be hopelessly out of season.

The wide-awake business man will study his locality and suit his advertising copy to local conditions. For instance, in localities where the public water supply is derived from a surface source, during an epidemic of typhoid fever the time would be ripe for advertising and selling water filters. In the wintertime, in cold localities, where the usual contract work is at a standstill on account of the weather and water freezing in pipes is a common source of trouble, an advertisement to the effect that the plumber had a steam or electric apparatus for quickly and cheaply thawing the pipes would be seasonable and appealing, for it would impress every householder troubled with frozen water pipes.

The foregoing examples are given to illustrate the point of time or season in advertising. The plumber should not forget, however, that his main business is selling and installing plumbing goods and fixtures, and should prepare most of his copy with that end in view. In order to attract prospective purchasers to his place of business he might state that he handles a well known and highly sanitary line of goods, which

are installed at reasonable cost, and point out the convenience of having running water in the house, the labor saved the woman of the house by having stationary laundry trays, and the delightful feeling of personal cleanliness as well as the health attending on the installation of a modern bath room. The talking points in plumbing are innumerable, and should be studied and worked over in an advertisement until they form a forceful and convincing appeal to the householder. Do not try to work in all the arguments in one ad, but take up one month the kitchen; next month the laundry, and then follow with the bath room, changing the copy at sufficiently frequent intervals so the story will, though old, be ever new.

Display in Advertising.—A good, neat, appropriate illustration goes far toward making an advertisement attractive, as well as attracting the attention of those who are interested in the subject. In order to be of value, however, the illustration should show the ideal, not the undesirable. No sane advertiser would show a picture of unsightly soil pipes, old pan closets, or copper bath tubs, nor should a plumber pay good money for space to frighten customers away with allegorical figures of disease arising in a cloud of sewer gas out of the drainage system. When advertising kitchen sinks, show a neat kitchen interior, or, at least, an attractive kitchen sink, with drip board, and let the copy be about the kitchen fixtures. When the laundry is under consideration let the copy be consistent and tell of the ease and convenience of having stationary tubs, with hot and cold

water and waste connections. The bath room should be treated the same way and when special apparatus, like water filters, are advertised, they should be illustrated, for what the eye sees the mind wants, if it is made suitably attractive. Cuts need not be used always, however; there are times when an advertiser has something interesting to say and can say it to his public in a frank heart-to-heart talk on paper. In selecting illustrations for newspaper advertising it is well to bear in mind that only line drawings or stipple work can be successfully used. Owing to the coarse texture of newspapers and the speed with which they are printed half-tone reproductions of photographs require such coarse screens that very little detail is left of the pictures.

The location of an advertisement in a paper, with regard to the other advertising copy, should influence somewhat the display. Having paid for the space the advertiser wants to get out of it all that he possibly can. For this reason he must study his copy to see what kind of border to use to distinguish his advertisement from the rest. If the others are all heavy black borders, a light border with a wide margin between the copy and the border might display the advertisement to the best advantage. If, on the other hand, the other advertisements have light borders, a heavy black border might be the most effective. The main point to remember is to study the advertising the same as you would any other business detail. You will be judged to a great extent by the card you offer the public, and, so that the judgment will be favorable, see that the copy is not lacking in any of the little details that make perfect. Besides, you are

expending money for business purposes and you must make advertising money bring as great returns as any other expenditure.

Size of Advertising Space.—The size of space purchased in the papers need not be large. It is the quality of the copy more than the size of space which counts. Ordinarily a 3-inch space in single column will be found sufficient, although the style of advertisement and display may be frequently changed with advantage by running a double-column advertisement of about 3-inch space. Frequency of issue is of as much importance as size of space, or, perhaps more so, for it is the frequent recurrence of an advertisement which ultimately stamps it on the memory; consequently, it would be better to run a single column of 3 inches daily than to carry double that amount of space two or three times a week.

Advertising Mediums.—Of the various mediums offered for advertising there are none better than the local newspapers and street-car signs. If these two mediums are properly worked they should produce in time a rich harvest of prospects from among which the plumber, by the exercise of the quality of salesmanship, should land a number of orders. It should be borne in mind that advertising does not sell goods; it merely creates the desire to own them, and, the prospective purchaser having signified his intention to buy, or desire to own, it remains for the salesman to complete the transaction.

In addition to newspaper and street-car advertising very good results can be secured by sending out to home owners a well-printed, nicely illustrated

little booklet, showing various bath-room interiors, laundry arrangements and kitchen equipments. By this means the woman of the house has brought before her in pleasing form the possibilities and benefits of plumbing fixtures, and inseparably connected with this impression is the name of the business man who sent the booklet. If such advertising literature is to produce the desired results, however, the paper must be good, the illustrations very fine and the typography excellent. If the booklet is poorly arranged, printed or illustrated, instead of making a good impression it will be valueless, or actually do harm.

Advertising Returns.—The benefits of advertising are cumulative, and must not be expected to bring immediate and overwhelming results. It is the constant, steady hammering away at the same subject which ultimately counts. Nobody can foretell just how far-reaching certain copy may prove, and if the store is not besieged by interested persons the day after an advertisement is inserted do not grow discouraged, for as late as a year after people will call on business who were first attracted by the common sense and reasons in your advertisements.

Incidental Advertising.—The wide-awake business man can gain much publicity of a paying kind by keeping his name and business constantly before the public in the form of little news items, interesting write-ups and interviews published in the local papers. Whenever anything of a new or unusual nature is done by the plumber, it constitutes news, and as such will be welcome to the papers if a nicely written account of it is sent to the editors. If there

are more than one paper in the city furnish each with a different presentation of the same matter, so that the several accounts will look like the different accounts of the respective reporters of the papers publishing the accounts. In order to be acceptable to the editors, and to have any weight with the public, or value as advertising matter, the article must be of real interest to at least part of the readers. Nobody is interested in the statement that "Sol Leader is going to New York today to lay in a supply of goods for the anticipated summer trade," but they would be vitally interested to know that a plant for the purification of sewage, the first to be constructed in the vicinity, had been completed for the Pelham Country Club by Sol Leader, together with photographic reproductions of the plant, a popular description of its operation and directions for reaching the site to view the sparkling, clear, wholesome water resulting from the treatment.

Such articles, and there are hundreds of them in the plumbing business, which the foregoing will suggest, are news, and as such, welcome to the press. On the other hand, the advertising secured is of the highest order, as it shows the public the class of work the contractor does and identifies him with work of an important nature. Likewise, the installation of a water-purification plant, water filter, water-softening apparatus, or anything which can be worked up in a popular way, will prove valuable advertising for the plumber as well as good reading matter for the editor.

Cultivate, also, the practice of expressing views for publication on all matters pertaining to sanita-

tion. Reporters are always on the lookout for some one to interview, and when matters of sanitation are up for discussion they turn naturally to those whom they know will talk for publication. This places you in the position of an authority, and you are quickly looked upon as such by the public. For the benefit of the Sunday editions of your home papers, discussion of public baths, public comfort stations, clean streets and like subjects will keep you prominently to the fore and confirm the good opinion gained by your former utterances.

Neat signs on prominent buildings, stating that you are doing the plumbing work, will help along your publicity campaign, but far and above all other methods of advertising must be the pleased customers for whom you have done good work. There is no possible advertising medium like good work and reliable fixtures. The woman who is pleased with her bath room and is never troubled with the apparatus getting out of order will show the fixtures to her friends with pride and boast of the fact that they have been noiseless in operation and have given no trouble.

Try to make each person for whom work is done a living, talking, enthusiastic representative and advertiser.

Salesmanship.—As a rule, advertising only creates a demand for goods, a desire to own, and discloses those who are interested. It is then that salesmanship must take up the transaction and negotiate the sale to a successful conclusion. Just what constitutes good salesmanship is hard to say; generally it

is a personal characteristic, although the accomplishment may be acquired. To this end, it is well for the business man to read carefully one or more books on the subject, to learn what are some of the successful methods employed by good salesmen. Of course, personality and magnetism have much to do with this branch of business, but honesty, sincerity and fair dealing will go a long way to overcome any natural deficiency. It is well to bear in mind that talking or chatter is not salesmanship, and that telling funny stories not only disgusts the prospective purchaser but takes his mind off the object he has in mind. On the other hand, do not be too taciturn; answer all inquiries promptly and frankly, without being "windy." If the prospective purchaser is in doubt and asks for advice, guide him in the selection of fixtures to the best of your ability. In doing so good judgment and a knowledge of the tastes and resources of the purchaser are invaluable. If the shopper has only a moderate income he will not be interested in extremely costly goods, and to show such will only make him dissatisfied with what he might otherwise have purchased with pleasure. On the other hand, if expense is no consideration to the shopper, show a line of goods likely to suit, regardless of the price. Oftentimes an individual enters a shop who has already given the subject much consideration, and from a study of catalogues and advertisements knows just what he wants. Unless in your judgment he is making some grave error, which later will reflect back on you, do not try to talk him into buying something else. If he is making a mistake in the selection

of his goods point out the error to him so later he cannot blame you for the failure.

It will pay the business man to become identified in his trade with only reliable goods. It matters little to him if he saves a few dollars on an operation by the substitution of inferior goods, only to lose the trade he has worked years to build up. There is no salesmanship so good as giving customers not only all they pay for, but a little more besides, for pleased customers are your best salesmen.

Keep posted as to the quality of woodwork and trimmings for seats and closets, and carry in stock only such kinds as will give good service, then use these as talking points when pointing out the quality of your line of goods. See that only the best of ball cocks, which will not leak and do not make a noise, are used in all closet tanks you handle, and be sure that the flush valve is of a kind that will not continually waste water and make a noise by leaking continuously; get away as far as possible from putty joints in plumbing, and use only flexible metal to metal floor connections for water closets and slop sinks; then call the attention of your prospective purchaser to the superior quality of such goods. If you can get goods that are guaranteed by the manufacturers, combine your reputation with them, and impress on all who call to look at your goods that all your fixtures are guaranteed, both by the maker and by yourself. Confidence in one's own goods begets confidence in the purchaser, and as between guaranteed and unguaranteed goods they will not hesitate in choice.

The plumbing contractor cannot always be in the shop to sell goods to people who call, so it will be to

his interest to secure the services of a bookkeeper who is an all-round office man and can tend to sales during his absence. Impress on the bookkeeper's mind the facts about your line of goods and that you want to sell only guaranteed goods; that if people want anything else you will furnish it at their own risk and that you positively do not recommend them. Many sales that would otherwise be lost can be made by having a good representative in the shop.

Suggestion in Business.—The young contractor should bear in mind that suggestion is the source of business enterprise, and the highest quality of salesmanship. If people never purchased goods or had work done until they thought of doing so themselves, only a fraction of the present volume of business would be transacted. Wrapped up in their own affairs, most busy men are not aware of improvements and new devices that will increase their plant's capacity or otherwise improve their business detail until such appliances are brought to their attention, when they are gladly adopted. Business is such at the present time that all heads of concerns expect to have brought to their notice by the interested parties anything which will be of benefit to the business, and it might be added, they are waiting open armed to welcome anything providing its benefit can be demonstrated to them. The writer recalls a large sugar refinery in New Orleans which did not have a sink or slop sink on any of its several floors. Upon bringing the matter to the attention of the manager orders were immediately given to equip the building through-

out, and the manager was reasonably angry because nobody had suggested the benefit of sinks before.

So, learn to suggest improvements to everybody you meet in a business way, and, wherever there is an opportunity, make a special effort to interest people in work along your line which will benefit them. As a concrete example: If the water in the locality where you are situated is hard, suggest to mills and factories where a large quantity of water is used, both for boiler feed and industrial purposes, the advisability of putting in a water-softening apparatus. Of course, to do so you must post yourself regarding water softeners, then, primed to the muzzle, go to the manager of the concern for a good, vigorous discussion of the matter. If, on the other hand, the water supply is derived from a surface source point out the value of filters as a safeguard from disease, and advise their installation wherever they will do any good.

In many homes gas ranges are now used instead of coal ranges and some means must be provided for heating water for domestic use. Instantaneous automatic water heaters will prove suitable for this purpose, and if the practice is systematically made of suggesting their installation it is surprising how many orders will be received.

Again, most people take pride in their bath rooms and want in them only fixtures of the very best type. If you point out to a man who would not wear a last year's suit of clothes, or who insists on having a new automobile every time there is a change in design, that his water closet is a washout, and not nearly so desirable a type as the syphon jet, he will not hesitate

long about giving an order for the better type. "Fashion wears out more apparel than the man" is an old saying, which holds true in other lines. Almost everybody who can remember back twelve years can recall how people who rode bicycles changed the machine every year because some trifling change made the design of their machine old, and while the machine was seen in public, while bath rooms are private, still most people who own their homes want only the best in the way of plumbing fixtures.

The smoke-testing machine is another means of creating business. In most of the old buildings throughout the land, there are leaks in the drainage system, and all that is necessary is to smoke them out. Once you get the order to overhaul the piping within a building, your salesmanship ought to prevail upon the owner to install new fixtures in place of the old style fixtures now in use, and perhaps induce him to put in some new fixtures where none now exist. Make a practice, then, of advocating the smoke testing of old work.

The foregoing are but suggestions to point out to the young contractor the possibilities of suggestion. There is no limit to the business which can be drummed up by judicious suggestion cultivated and practiced. What particular lines the suggestion shall take are matters of local conditions which must be studied out in each case and acted upon. The main thing is to impress on the beginner's mind the value of suggestion.

There is another value attached to suggestion which has not yet been mentioned. If the plumbing contractor calls upon the manager of some concern,

impresses him favorably and gives good reasons why his suggestion should be acted upon, conducting himself throughout the interview in a businesslike way and impressing the manager with the fact that he thoroughly understands his business, he will not be forgotten, even though he does not secure an order. The interview is at once an introduction and an advertisement, and when that manager is in need of technical information or wants work done he cannot forget the contractor.

Cost-Marking Goods.—When a prospective purchaser asks the price of a fixture the answer must be forthcoming without delay if you wish to hold the attention of the customer. Nothing seems to so irritate a man as to stand around while the cost of an article is looked up in a catalogue by the proprietor. Attach to each fixture as soon as it is put on exhibition a little tag showing the cost and the selling price. Then, when the question is asked it can be answered immediately. The cost price is always marked in cipher, and very frequently the selling price is marked likewise. These private, or cipher marks may consist of a series of ten letters, which may or may not spell a word, and an extra letter or character used as a repeater, to obviate the necessity of repeating one of the other letters in such combinations as 44, 66, 33, or some arbitrary signs or characters may be used instead of the letters. It is well to have a cost and selling price on the fixture alone, and additional costs and selling prices for the fixture trimmed with different fittings. For example, one man might want just the fixture itself to replace a defective one, figuring on

using the old trimming, while different purchasers might want a certain fixture fitted with different trimmings, and it is well to be able to quote on any combination of fittings without hesitation. The following words are frequently used as private marks, although any other words of ten letters may be substituted:

B l a c k H o r s e
C a s h P r o f i t
H a r d M o n e y s
I m p o r t a n c e
1 2 3 4 5 6 7 8 9 0
X is used as a repeater.

EXAMPLE.—Using the first words, "Black Horse," as a key, how would the cost price of $1.90, and the selling price of $3.25 be expressed?

SOLUTION.—The cost mark would be above a horizontal line, and the selling price below the line. In the foregoing example the cost price, $1.90. would be represented by the first, ninth and last letters of the key, which are *bse.* The selling price, $3.25, would be represented by the third, second and fifth letters of the key, or *alk.* When placed on the tag affixed to the article the cost and selling prices would be written

$$\frac{bse}{alk}$$

A simple cost mark can be made up from the key shown in Fig. 36. In this a single line, either horizontal or vertical, represents naught, while the various numbers, from 1 to 9 inclusive, are written as shown in Fig. 37. Decimals are written the same as in ordinary figures, and the period, or decimal point,

is represented by a dot. Using this key the sum $1.59 would be written in the following manner:

A cost mark which is not so easy to read and not so common as the one just shown is illustrated in Fig. 38. The principle upon which this cost mark is constructed is that the horizontal lines at the top of perpendicular lines, on either side, count one; those at the middle count two, while those at the bottom of the perpendicular line count three. A perpendicular line alone represents naught. Starting with the perpendicular line, which is of no value, by adding horizontal lines of known value to it any number up to 9

Fig. 36

Fig. 37

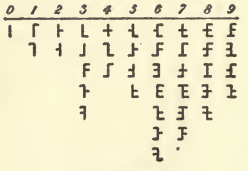

Fig. 38

may be expressed and, as may be seen by the illustration, in a number of ways. Having the 10 cardinal numbers, any combination of figures may be expressed. If this cost mark is to be used the plumber should study it carefully until thoroughly familiar with the different combinations by which any number can be indicated. This may then be used for the cost mark, and a simpler mark for the selling price. By this method he and the bookkeeper alone would hold the key to the cost price, while the other employees,

who might be in charge of the shop at odd times, could be given the key to the selling price.

There seems to be a marked tendency at present to write the selling price in plain figures so that any person can see at a glance what the various fixtures will cost the purchaser. Much can be said for this plan, for there is no good reason for keeping the selling price secret, while much good might follow marking the selling price in plain figures. If no other good is accomplished it shows the purchaser that the shop is run on the one-price plan, and that the same price is quoted to all inquirers. Whether the plain mark or secret mark be used for the selling price, however, is a matter for each business man to decide for himself.

In figuring the cost of goods to himself, when cost-marking goods, the plumber should not overlook the items of freight, drayage and operating expenses.

Soliciting Business.—In this age of hustle the plumber, if he wishes to succeed, cannot do so by waiting in his shop or office for business to come in, no matter how extensively he advertises. The energetic business man will not sit around waiting, like Micawber, for something to turn up, but will go out to solicit business wherever work is to be done. His first aim should be to get his name on the mailing list of architects and general contractors, so that when they have anything in his line to estimate on a card will be mailed to him notifying him of that fact. It is not an easy matter to get the *entree* to the best offices, and the plumber should not become discouraged with repeated failures, but stick to his purpose, determined to win out in the end. If the privilege of

estimating on a certain architect's work is worth having it is worth waiting and fighting for. The architect who has made a name for himself does not care to have irresponsible contractors estimating for him, and will not permit it, so that the young business man cannot expect that privilege until he has been long enough in business to establish himself and prove his worth. He should call regularly, though, and make application at frequent intervals, for the very perseverance will finally have its effect. In calling on an architect do not request the privilege of figuring on "anything" he might have in your line, but learn beforehand of some work he has on the boards and then make a specific request to estimate on that work. Depend on it, if once the *entree* to the office is gained, it will not be withdrawn unless for cause. When all other means fail it is sometimes a good stroke to secure a note from the owner of a building directing the architect to extend to you the privilege of figuring on that operation. Having by this means gained entrance to the office your future success or failure there will depend much upon yourself.

It might be well to point out here the value of personal appearance in gaining entrance to an office. The man who is well groomed and prosperous looking will succeed in eluding the guard at the outer portal where a more carelessly dressed person would be turned away. When you want the privilege of estimating on certain work do not tell your wishes to the office boy who insolently asks your business, but state emphatically that you have business with his employer and want to see him personally. The office boy has no authority in the matter, but, if he finds you simple

enough to assume he has, will live up to the assumption and turn you down.

Submitting an Estimate.—It is assumed that in submitting an estimate the plumber does so honestly, in all fairness, and without collusion or combination with other contractors. These introductory remarks might be out of place if it were not for the dishonest practice in some cities for a certain clique of contractors to combine, and, knowing they are the only ones estimating for a certain architect or owner, decide among themselves who shall submit the lowest estimate, how much it shall be and what prices the remaining contractors shall offer to do the work for. Indeed, it was only a short time ago that the building committee for a large building refused to consider the bids submitted by plumbing contractors in their own town and went outside of the city to secure a fair and reasonable estimate. In doing so they made public their reason, which did not reflect much credit on the honesty and fair dealing of the local plumbers. In reporting the matter the committee said:

"Having knowledge of the cost of the fixtures proposed to be used and having carefully estimated the cost of setting the same and adding a reasonable profit on the entire contract, your committee were surprised upon opening the above bids to find that they materially exceeded our estimate. Upon investigation we were informed that a meeting of the above bidders had been held previous to handing in their bids, at which meeting, we were informed, it was decided who should be the lowest bidder; which low bidder was to furnish his figures to the other bidders who were to present higher bids. This action seemed so reprehensible and savored so strongly of collusion that the

committee rejected all bids and secured an estimate from a thoroughly reliable plumbing firm to furnish the fixtures and to install the same at a considerable saving over the prices submitted by the combine."

Such a proceeding is not only reprehensible but, likewise, it is a bad business policy. Once such a combination is worked on an architect the doors of his office will thereafter be closed to all who entered into the combine, and the news of the attempt to hold up an architect by means of an unlawful combination will travel fast and will not impress those who learn of the business incapacity and lack of fair dealings of those in the ring. The way to succeed is to master thoroughly the details of the business and the practice of plumbing, then, secure in the strength of your position, refuse to enter into unfair combinations and carve out your business future by fair dealings, accurate estimating, close application to business and mastery of detail.

The contractor might gain a temporary advantage by combining with others to stifle competition, but in the end he will lose, and his wit not having been sharpened and his business methods improved by fair competition he will fail in the end.

If for any reason—such, for instance, as so much work on hand that you cannot handle more— you do not care to estimate on an operation, frankly tell the architect so. He will respect your fair dealings then and keep your name on his estimating list, while otherwise he would have to cross it off if he learned that for whatever reason, however innocent, you had submitted an estimate based on those submitted by others.

Form of Tender.—Having arrived at the price for which the contractor is willing to do a certain piece of work, all that remains is to send a formal bid for the work to the architect, owner or whoever has the letting of the contract. When all points regarding the work are fully covered in the plans and specifications all that will be needed is a little tender like the following:

PHILADELPHIA, PA., May 14, 1908.

HOWARD & GROVE,
496 Penn Avenue, City.

GENTLEMEN—We propose to furnish all labor and materials according to the plans and specifications for the plumbing work in the twelve-story office building, corner of Wayne and Perry streets, Hall and Johnson, owners, for the sum of Six Thousand ($6,000) Dollars.

Respectfully yours,
FERRIS & CO.

There are a number of conditions which must be considered, however, before an estimate is submitted. For instance, if such a bid were submitted to the owner, or to the architects who were authorized to act for him, and it were accepted by sending a line like the following:

FERRIS & CO.,
City.

GENTLEMEN—Your offer to furnish all labor and materials for the plumbing work in the twelve-story office building, corner of Wayne and Perry streets, Hall and Johnson, owners, for the sum of Six Thousand ($6,000) Dollars is hereby accepted.

Very truly yours,
HOWARD & GROVE.

These two letters, together with the plans and specifications, would constitute a contract, and the plumber can be held to the terms of the agreement. If, now, no plan of payment was mentioned in the specifications, no money would be due, according to the agreement, until the entire work was completed, when the contractor would be entitled to the full Six Thousand Dollars.

When figuring on large operations where no form of payment is mentioned in the specifications the plumbing contractor can protect himself from such a possibility by stipulating in his tender how the payments are to be made, or by leaving the payments open for further consideration until the time of signing a formal contract. This he can do by stating in his bid that the time and manner of payments are to be decided later if awarded the work and a formal contract be entered into. In that event notice that he has been awarded the work does not constitute a contract, because something is left open for further consideration, and the work is not formally awarded until the contract is signed.

When a bid leaving something, such as payments, open for further consideration is submitted, either party to the agreement can withdraw up to the time when a formal contract is signed. If, on the other hand, a definite offer is made and the offer is unqualifiedly accepted—for example, as indicated by the two preceding forms—the contract becomes consummated as soon as the acceptance is mailed, and thereafter neither party can withdraw without the consent of the other party. If the owner then wishes to insist that the plumbing work be finished before payment,

that is his privilege and from the terms there is no relief, although he may waive that privilege and make payment as the work progresses.

There is another phase of the matter which is worth remembering. In the absence of a definite statement as to how long the tender shall remain open it may be accepted within a reasonable time, and that reasonable time might be construed by the courts to be anywhere from one to twelve months. The significance of this lies in the fact that a bid might be submitted, be forgotten for awhile, then, after the prices of material had all gone up and the other contractors had withdrawn their bids or otherwise protected themselves, the only remaining contractor might, to his sorrow, have his estimate accepted. To avoid any such contingency each estimate sent out should have a time limit stated on it. If the markets are unsteady and prices constantly rising, or threatening to rise, estimates should have stamped conspicuously on the face: "For immediate acceptance only." When conditions are settled, and there is no danger of losing by leaving a bid open for a reasonable time, a time limit of thirty days should be placed on the estimate. That should be a sufficiently long period of time in which for the owner to make up his mind, and at the same time it affords the contractor reasonable protection. For such cases estimate blanks should be prepared or the contractor should have a rubber stamp bearing the statement: "This estimate good only for thirty days."

An energetic contractor will have many estimates out at all times, and if he should find himself loaded up with all the work he can reasonably handle with

the capital invested in the business he should immediately withdraw all quotations. This can be done by consulting his estimate blanks and sending out to each person who has not accepted his offer a brief note stating that his quotation, or estimate, of a certain date for certain work is withdrawn. This will protect him from being swamped with contracts for work which he cannot perform.

Signing the Contract.—If a formal contract is to be entered into, when the time comes for signing the contract read it through carefully to satisfy yourself that there are no objectionable clauses. If by the terms of the contract you are to waive your rights to certain protection, such as the lien laws, do not hesitate to ask for some other security to take the place of what you are asked to dispense with. Bear in mind that the fairest and best contract that can be written and signed is a simple, plain statement setting forth what the contractor is expected to do for his money, and how much and in what manner he is to be paid for the work. The more clauses and conditions contained in a contract the more conflicting they become, the harder to comply with, and, finally, the more loopholes for trapping the unwary. Above all precautions, NEVER SIGN A PRINTED FORM OF CONTRACT. If one is presented for signature ask for time to read it through and consider its provisions, then submit it to your lawyer for his opinion. Never, under any consideration, sign a printed form of contract without the advice of your lawyer, and it would be wiser to do so not even then. There is no occasion for a whole sheet of printed conditions for a

plumbing contract. The trouble arises from trying to use a general form applicable to all building contracts. The forms are prepared by lawyers who have studied contract law in all its crooked windings, and, under the guise of an innocent looking clause, insert some conditions which are harmful to the contractor. All of the conditions which both parties to the contract are expected to live up to should be stated in the specifications, and that leaves for consideration in the contract proper only the amount and terms of payment. If more is insisted on refuse to sign it.

Form of Contract.—A simple form of contract which will be found sufficient for most cases may be worded as follows:

Memorandum of Agreement entered into the 14th day of May, 1908, between Ferris & Company, of the city of Philadelphia, State of Pennsylvania, parties of the first part, and Hall Johnson, of the same place, parties of the second part. The said parties of the first part, in consideration of $6,000, hereby agree to and with the parties of the second part to furnish all materials and labor according to the plans and specifications prepared by Howard & Grove for the plumbing work in the twelve-story office building, corner of Wayne and Perry Streets, Philadelphia, and owned by the parties of the second part; and the said parties of the second part, in consideration of the same, agree to pay to the said parties of the first part Six Thousand ($6,000) Dollars lawful money of the United States, in the manner stated in the specifications.

(Signed) Ferris & Company,
Hall & Johnson.

In case the terms of payment were not stated in the specifications they should be recited in the con-

tract so there would be nothing left undetermined. In short, the memorandum simply reduces to writing in the plainest terms what each party to the contract is to do.

Different Plans of Letting Contracts.—There are three different plans of letting contracts, all of which the contractor should be thoroughly familiar with. The difference between the three methods lies in the manner of compensating the contractor for his knowledge, experience and effort. The simplest and best known form of contract is the lump-sum contract. According to this method the contractor estimates the cost to himself for performing a certain piece of work, adds his operating expenses and profit, and then, if awarded the contract, does it for that price, make or lose. If the contractor is an accurate estimator, a close buyer, skilled designer and good handler of men, he can sometimes make on his work a small percentage more than he had figured. If, on the other hand, he is inaccurate in figures, a poor buyer, unskilled designer and has no control over his men, the chances are that he will either lose on the work or will have to slight some of the detail in order to pull through without loss. At its best this form of contract puts one party against the other. The contractor's interests seem to lie in doing the least work and supplying the poorest materials which will prove acceptable, while the owner's interests prompt him to seek the best and most that he can claim under the terms of the contract. The result is there is seldom harmony and good feeling when extremes meet. With most of the responsible contractors, however, everything is sup-

plied that their contract calls for and there is no friction between contractor and owner. Still, for the sake of contrasting the different methods of letting contracts, it may be said that in the lump-sum contract the interest of the contracting parties are opposed.

The next in order is the percentage plan of letting contracts. According to this method the contractor furnishes all material and labor without any other agreement than that he will furnish them at a certain percentage above their cost to him. This method is a highly satisfactory way of doing business if the contractor is honest, but if not overscrupulous in his dealings the door is open to many ways of mulcting the owner. More men can be put on the work than can be economically used; inferior or slow workmen can be put on such contracts, while the good workmen are reserved for lump-sum contract work; a full and fair day's work might not be required of the men; more material might be used than is economically required; more expensive goods ordered than the operation warrants, and last, but not least, the dishonest contractor is tempted to pay more for his goods than their regular market value. In fact, the more the operation costs the more there is in it for the contractor, and a dishonest contractor might run the cost far above what rightly it should be. In the percentage form of contract, then, it may be said that the interests of the contracting parties are not the same, and that the interest of the contractor is to run the cost far above what good design and installation require and far above what the owner wishes.

The final and best plan of letting contracts is by the cost-plus-a-fixed-sum method. By this plan the cost of an operation is estimated the same as for a lump-sum contract, and the profit for the work determined in the same manner. Having determined the profit for that operation, that forms the basis of remuneration for the contractor, who gets no more or no less, regardless of what the work costs to install. According to this method it will be seen there is no incentive to make the work cost more, but, on the contrary, all the incentive in the world for keeping the cost below that estimated. If it were above the estimated price it means nothing in the pocket of the contractor, but it does mean a dissatisfied owner and, perhaps, a loss of future business to the contractor. To illustrate this method: assume that by estimating an operation it was found that it would cost, net, $6,000. Assume further that the contractor's operating expenses are 7 per cent. and that he figures a profit of 8 per cent. Then the compensation to the contractor would be 8 per cent. plus the 7 per cent. operating expenses on the estimated cost of the operation. Seven per cent. of $6,000 equals $420 and 8 per cent. of $6,420 equals $933.60, which is what would be paid the contractor for his skill in design, services in assembling and purchasing material, and the handling of men. According to this plan of letting contracts the interest of both parties to the contract are identical. They both want the very best installation which can be put in for the cost allowed. If the work is not all that it should be the defects will reflect on the contractor, while if the work gives satisfaction it will redound to his credit.

Another feature of such a method of letting contracts lies in the fact that the owner at any time can alter his plans without trouble or without increasing the cost above that necessary for the material and labor.

Day Work.—The plan of doing work by the day is seldom applied to large undertakings, but is generally confined to small orders for repairs or alterations. When so applied, the day-work plan operates very satisfactorily. An order is received to do certain work for a patron, a plumber is sent to do the work, and the time and materials required are charged up to the owner. The rate of charge in such cases is generally regulated by the master plumbers in the various cities throughout the country, who establish a certain price to be charged per hour for a plumber or fitter and helper, and set a certain percentage to charge for the goods supplied. The rates and percentages so charged, however, are based on jobbing work, and it would be obviously unfair to use the same schedule in charging a patron for completely overhauling the plumbing in his home. In jobbing and repair work there is considerable lost time and wasted materials, besides such small items as candles, red lead, white lead, putty and like articles that cannot very well be charged for, yet in the aggregate they amount to a considerable sum; and, in order to cover such uncharged items, lost time and waste, the rate per day charged for the plumber and the percentage of profit charged for the goods are comparatively high; much higher, in fact, than a plumber would add to his estimate if called

upon to bid in open competition for work of any magnitude. If, therefore, a friend or patron, reposing full confidence in your honesty and ability, authorizes you to go ahead with his work without price and without competition, manifestly the honorable thing to do would be to add a percentage of profit for the labor and materials that would be perfectly fair to the customer and that would take no advantage of his friendship or good will. What would be a perfectly fair rate of profit on repair work of less than twenty dollars, might, and no doubt would, be an unreasonable charge or rate on a three hundred dollar installation. The contractor must, above all other things, be fair. The craft has long suffered under the imputation—deserved in some instances, undeserved in others—of being robbers; and if the young business man expects to succeed, he must avoid gaining such a reputation

CHAPTER VI

OFFICE METHODS

KEEPING Books.—The keeping of a complete set of books so that the exact standing of the business can be determined any time has already been mentioned. Little more need be said on the subject, as the necessity and advisability of such a course is evident to everybody who aspires to a place in the business world.

Without a complete set of books and complete records of all work, showing whether there is a profit or loss sustained by each operation, the success of a contractor will be an accident, not the result of careful business methods.

In selecting a bookkeeper try to secure one who at the same time is a good salesman, even though more has to be paid for his services. Indeed, a good salesman will pay for himself over and over again by the business he secures for the contractor.

Auditing Bills.—No bill should ever be paid without going over the items carefully to check them up and see that nothing is charged for that was not de-

livered, or that nothing is charged for at a higher price than what you are paying for that line of goods When you are purchasing soil pipe for, say, 80 and 10 per cent. off the list, in making out the bills the clerks might allow only 80 per cent. discount, and that extra 10 per cent., if it represents what you are overcharged on all accounts, will amount to considerable in the course of a year. Indeed, the writer has in mind an average saving of $100 a month effected just by auditing bills and checking up such little inaccuracies as are here pointed out. When the bills have all been audited and the differences in price between those quoted and what are billed noted do not be afraid to return the bills for correction or for a memorandum of credit. Business houses like to deal with contractors who look after the details of the business, for it augurs well for their success and a long and pleasant continuation of business relations. By all means, then, audit your bills.

Discounting Bills.—In the business world thirty days is considered cash. That is to say, if the bills are paid thirty days after shipment of the goods it is considered as being a cash transaction. In some lines sixty days is considered cash, but in the majority of cases, and particularly in the plumbing-supply business, thirty days is the recognized time for the payment of bills. In following out the policy of payment all bills may be paid on certain dates—such, for instance, as the first day of each month—or each individual bill may be paid thirty days from its date.

In order to induce purchasers to pay for their goods before the expiration of thirty days, ready

money being necessary for the conducting of a large business, supply houses offer a premium of 2 per cent. to those who will pay their bills within ten days of shipment. That is to say, an additional 2 per cent. is allowed off the net amount due for a bill of goods, and not off the gross cost of the goods before the discount was deducted. To illustrate: If the cost of a shipment of soil pipe, according to the list price, amounted to $800, and it is subject to a discount of 60 per cent., the net amount due the supply house at the expiration of thirty days would be $800 x.40 = $320. Now, if instead of waiting thirty days before paying the $320 the contractor wishes to take advantage of the 2 per cent. cash offer, at the expiration of his ten days he would send his check for $320 less 2 per cent., or $320 x.98 = $313.60. By this simple method he saves $6.40 by paying one bill twenty days sooner than it is due. This in itself might seem a small sum to be interested in, but in business it is the small items that should be looked after, for it is not likely that a large item of expense will be overlooked, and when the saving effected by discounting bills is looked at in the proper light it is not a small item by any means. For the use of money for twenty days the supply houses pay as much interest as most savings banks pay for the use of money for a whole year. Think it over. At the rate of 2 per cent. for twenty days it amounts to over 36 per cent. per annum—a nice reward for promptly paying one's debts. Look at it in another way. Suppose the purchases of a contractor amounts to $20,000 per annum and he takes advantage of the 2 per cent. discount on all his

bills. In that case he will have saved $400 simply by discounting.

It will thus be seen that considerable money can be saved by discounting one's bills. But there is a further profit, which has not yet been mentioned. The business of a contractor who pays his bills promptly is worth more to a supply house than the business of those who are notoriously slow pay, and just as in the contractor's business he will do work cheaper for a reliable concern which pays promptly than he will for a concern which is a slow pay, so will the supply houses give better terms to their prompt customers than to their slow ones. It pays, therefore, in more ways than one to have the reputation of discounting bills, and whenever a contractor has sufficient working capital to warrant such a course it is earnestly recommended. Unless, however, the contractor has sufficient working capital to take advantage of the benefits of discounting without crippling his business he had better not do so. There are times in business when time is of more consideration than the extra 2 per cent., and if the contractor is carrying considerable work with a large payroll it might be advisable to allow the 2 per cent. discount to go by default and keep his ready money for the current expenses, pending payments on his several contracts. The contractor, himself, is the only one who can determine which course to pursue, and all that is necessary here is to point out to him the advantages and profits accruing from the practice of discounting bills.

Catalogue Cabinet.—The value of catalogues in business should not be overlooked by the plumbing

contractor, who will do well to provide himself with a cabinet or book case for the filing of his catalogues, and some letter files, duly indexed, in which he can keep the small pamphlets.

If the various catalogues sent out by the different plumbing-supply houses are carefully studied they will prove an education in themselves, which the plumbing contractor cannot well get along without. These books, if intelligently looked through, will keep the plumber posted on the various apparatus and devices in the market which are suitable for certain purposes. They will furnish the address, so that any article listed can be readily ordered, and the very knowledge that certain goods are obtainable will, or ought to, suggest to the enterprising plumbing contractor means of making sales. For instance, if the water supply in his locality is muddy, a catalogue of filters ought to suggest to his mind the possibility of selling one to laundries, hotels and public institutions like hospitals, as well as to private individuals, and if he follows that suggestion by a vigorous canvass of all prospects he should land some valuable orders, besides introducing himself favorably to those who do not buy.

Look through the columns of the trade papers and send for a catalogue of every article mentioned on its pages; then, as new advertisements appear, or are seen in other mediums, systematically follow them up until your catalogue case is stocked with booklets about everything on the market pertaining to your business, and note in doing so how much you have learned that you did not know before. It would seem that the benefits arising from such a course are

so self evident that every business man would do so, and the foregoing suggestion would be unnecessary; but the experience of receiving letters of inquiry from all parts of the country as to where certain goods could be purchased has taught the writer that the advertising columns of trade papers are not as closely scanned as they should be, and that catalogue cabinets are the exception instead of the rule.

Telephones.—In this age of quick communication, when time spent in running errands or writing unnecessary letters is money wasted, the plumbing contractor should have a telephone in his office and in his home. If he is doing a strictly contracting business and only handling new work, he must of necessity be in communication with his office at all times, and if he does a jobbing business many orders will be lost if people cannot reach him by phone. Indeed, if jobbing is catered to the plumber should have his home telephone number on all his stationery, with a statement that a call at that number would bring a man, day or night, in case of emergency. The money saved by workmen calling up the office for instructions or to order goods, will alone pay for the telephone many times over during the year, not to mention the various other savings and conveniences attendant on the use of the telephone.

CHAPTER VII

THE EXECUTION OF CONTRACTS

SUPERINTENDING the Work.—The young business man must not feel that because he estimates on the work, secures the contracts, audits the bills and cares for the office work that his whole duty is performed. It is useless to work out problems on paper if they are not put into practice on the installation, and the contractor should see that as much work is done and as little material used as he estimated on.

The only way he can satisfy himself on this subject is to give the work his personal supervision from time to time as it progresses, and to be particular to lay out the work and explain to the workmen just how it is to be done. The success of the contractor is supposed to be due in part to his skill in laying out work, and he must not expect his workmen to be equally skilful, or they would not be working as journeymen plumbers. Further, the contractor has all the time necessary at his command to study out the best way to rough-in the work, while the journey-

man feels that he must make a showing each day; consequently, he starts immediately installing the pipes, when a little time taken to plan his work would have been better. At all events, if the contractor expects the results he estimated on he should lay out the work for his men, and should give them detail drawings of complicated parts of the work. Having acquainted his foreman with the way the work is to be done, by visiting the various operations every few days and noting the reports sent in during the other days he can keep track of the progress of the work and assure himself it is moving as rapidly as he estimated. It does not pay to grow careless about superintending the work, for if the workmen find the employer is indifferent about the progress made, naturally they will become indifferent also.

Working with Tools.—It must be accepted as a rule to which there is no exception that the plumber cannot work with the tools after engaging in business, and at the same time look after the other details so as to make a success of the business venture. The contractor cannot be soliciting business, estimating work, interviewing architects and doing the various other things necessary to business and at the same time do his own work. Indeed, the time he puts in with the tools saving a dollar might lose him several hundred dollars worth of work; for in these busy times of keen competition people are not going to follow a business man to his work to award him a contract or get an estimate. Besides, as a business man he must dress the part, for people do not rate high the overalls business man, and, if working with

the tools, he cannot present a suitable appearance for business engagements. Of course, there are men who have started a successful business career in that way and there are others who will do so. But these men rose, or will rise, in spite of the drawback of having to do their own work and not because of the fact. If conditions are such that the work must be done by the contractor, why, necessity knows no law; but where he has sufficient working capital to pay for the labor he should do so. He has figured on paying out a certain sum of money for labor, the same as for materials, and he is only doing what he estimated to when he pays a workman. Besides, in his operating expenses he has figured a salary for himself, and he cannot expect to do two men's work and earn two wages.

Training of Men.—To successfully conduct the mechanical end of the business the contractor must have complete control over and be in harmony with his workmen. To do so he must treat them with fairness and pay them the prevailing rate of wages. They cannot, then, demur at his requirement of a fair day's work. He should try, further, to impress them with the fact that upon his success in securing contracts depends the regularity and permanence of their work, and that he cannot secure contracts if the men in his shop do not perform as large a day's work as do his competitor's workmen. Most workmen are fair and reasonable, and as a matter of satisfaction to themselves wish to do what is right and proper, and if a disturbance creator gets into the fold drop him as soon as possible, for just as one rotten

apple in a barrel will spoil all the rest, so will one discontented spirit in a shop spread dissatisfaction and discord among the men. Treat the men in your employ right; pay them the highest rate of wages, then exact of them the best equivalent in work. Make it a point to know the capacity and limitations of all the workmen in your locality, and when in need of help select only the workmen that will be satisfactory.

Selection of Helpers.—Very few contracting plumbers realize the value and importance of helpers and exercise sufficient care in their selection; yet no other factor so affects the quantity and quality of work turned out by a journeyman as the helper or apprentice he has for an assistant. There is no economy in robbing the cradle for boys to carry tools, just because they can be had for $3 per week. It is better to get an older boy who is ambitious to advance himself and pay him $6 per week for his services. The youth who thinks of nothing but baseball and quitting time is a drag to the journeyman instead of a help, while at the same time he is expected to do more work on account of the boy. It is a good plan never to employ a "friend of the family" as an apprentice or helper unless he is told emphatically that he works on an equal footing with the other boys, and that if he doesn't make good the plumber he is working with is authorized to let him go, and that plan should be systematically followed out. The plumber should be given to understand that he is credited with a helper whom he is expected to make work and if the helper is not satisfactory he is to send him to the shop.

By this means the contractor will soon learn what helpers are worth keeping and can let the others go.

The materials used in plumbing construction are so heavy, and such a strong boy is required for cutting threads and helping with the other work, that a helper under sixteen years of age is of but little value.

Workmen's Wages.—There are some workmen so superior to others in speed and judgment that they will perform at least one-third more work per day than the average amount turned out in a shop. When the services of such a man are secured his superior ability should be recognized and paid for accordingly. It is unreasonable and unjust to expect an expert workman to continue doing more and better work each day than his companions without recognizing his services. Indeed, if the proper spirit is to be maintained among the force, it is absolutely necessary to reward every effort in the contractor's behalf. If a workman puts up such speed that he is doing far more work than formerly, pay him for it. If he plans out a way to save material reward him for his interest. If this plan is followed out the contractor will soon surround himself with a well-disciplined crew of men full of loyalty and all zealous in his cause. If he does not pay for such services other contractors will and he will soon lose his good workmen.

Foremen.—The plumbing business seems the only one connected with building where foremen are not considered necessary; or if a plumber is put in charge of work he is not given extra compensation for his services. That is not as it should be. Either an operation does not require a foreman or it does. If

one is needed he should be selected on account of his fitness for the position, and if he possesses the necessary qualifications to place him above his fellow workmen he should be paid for the attainments. The practice has so long obtained in the business of letting each man shift for himself that outside of large shops in the very large cities foremen are dispensed with. Much better results will be obtained, however, by placing a foreman in charge of every operation and looking to him for results. If he is the right man for the position and he is paid for his services the contractor's interest will be looked after better than if he were present.

Supplying the Workmen with Materials.—So that workmen can work to the best advantage and not be held back for lack of materials the contractor should require his foreman to keep planning the work a few days ahead, so that all necessary materials can be ordered and delivered to the various operations in time to avoid delays. If some plan of ordering ahead is followed, not waiting until the plumber sends word he is unable to proceed for want of material, many hundred dollars in time can be saved every year.

PART III

BUSINESS LAW

CHAPTER VIII

THE LAW OF CONTRACTS

EXPLANATION of a Contract.—A contract is legally defined as an agreement, or undertaking between two or more parties, for the doing or the not doing of some particular thing. In order to be perfectly valid and binding, a contract must conform to certain legal requirements as to parties, subject matter, consideration and mutual understanding, and these requirements are known as the requisites of a valid contract. For instance, there must be more than one party to a contract, for it is obvious that a party cannot enter into an agreement with himself, either as an individual, or as individual as one party and as representative of another as the other party. Further both or all the parties to a contract must be legally capable of entering into a contract. A minor, a lunatic or the principal of an

agent, not authorized to act in such a capacity, is not responsible for debts contracted, therefore none of them could be parties to a contract. On the other hand, a legally appointed guardian for a lunatic or infant, or the duly accredited official of a municipality or corporation, is capable of becoming a party to a contract, for and in the stead of his principal, who then becomes legally responsible.

Again, it is conceivable that an agreement cannot be entered into between two or more persons without there is a subject matter. That is, something for the contracting parties to do, or not to do. For instance, a plumber might undertake to install the plumbing in a certain building, in which case the subject matter calls for the performance of work and furnishing of material. On the other hand, the plumber, having purchased property in a residence section, with the intention of erecting a shop thereon, might contract with his neighbors not to use the premises as business property, in which case the subject matter would call for the non-performance of a certain thing.

The third requisite of a valid contract is consideration. That is something given by one of the contracting parties for the work performed or money paid by the other. When a plumber undertakes to install the plumbing in a building for an owner, he performs the work for the money, or consideration, paid him by the owner. On the other hand, the consideration for the owner is the work performed and material furnished for the contract price. If a contract called for the plumber to furnish all material and labor and no consideration were expressed, that is, no pro-

vision made according to the terms of the contract to pay him for his trouble and outlay, the contract would be void, and the courts would not enforce it for lack of consideration. Sometimes, however, contracts are drawn, in which only a nominal consideration is expressed. That is, the contract stipulates: "In consideration of One Dollar and other valuable considerations in hand paid, the receipt of which is hereby acknowledged, etc." In such cases there is an expressed consideration, and even though the one dollar in hand paid might seem inadequate, the contract is nevertheless valid, for there is a consideration.

The final requisite of a valid contract is known as assent of the parties, but may be more clearly expressed as mutual understanding of the terms. This means that both parties must have in mind the same subject matter when the terms of the contract are made. For example, suppose an owner had an eight-story apartment house on one corner of a block, and a four-story apartment on another. The owner in the negotiation has in mind the eight-story building while the plumber has in mind the four-story structure. In that event, there is no mutual understanding, therefore there can be no agreement of minds on the terms, consequently, the contract which attempts to express the agreement is void.

Parties to a Contract.—Before signing a contract, the plumber should satisfy himself that the person with whom he is dealing is legally capable of making a contract or is duly authorized. If the person is not of age, is mentally unbalanced, is a bank-

rupt, and in some states is a married woman, the contract is void or voidable. Time, worry and money will be saved in such cases by taking up the matter with the natural or appointed guardian and have him sign the contract.

In the case of municipal, state and national governments, likewise in the case of corporations, some one officer is authorized to sign contracts similar to those for plumbing work, and before entering upon the performance of the contract, the plumber should satisfy himself that the right person had authorized him to proceed. Sometimes the plumber has to deal with the agent of an owner, in which case he must make certain that the agent is duly authorized in writing. Indeed, it is questionable if the authority of an agent to sign contracts for work affecting real estate would not have to be not only in writing, but sealed and acknowledged.

The architect is usually an agent of the owner, authorized to order new work and obligate the owner to pay the cost. Sometimes he is authorized to sign contracts, but that must be a specific authorization, not an implied one, in order to bind the owner. In public work, on the other hand, the architect has no authority to order changes or extras. If he does so, there is nothing to prevent those in authority from ratifying his act, but usually it is best to secure a written order for all extra work from the commissioners in charge of the building operation.

Statute of Frauds.—For the prevention of fraud, a code of laws called The Statute of Frauds, has been enacted in every state throughout the Union. These

statutes, while very similar, vary slightly in different states, so it will be of advantage to the plumber to look up its provisions in the state where he is located. Whatever the language used, the general tenor of the three principal sections of the various statutes is as follows:

1. "Any contract for the sale of land, or for the sale of any interest in land, to be binding, must be in writing and subscribed by the party to be charged therewith, or his agent duly authorized in writing."

2. "No agreement for the sale of goods or chattels of the value of fifty dollars or more, will be binding unless some note or memorandum of the agreement is in writing and signed by the party to be charged therewith or his duly authorized agent."

3. "No promise to answer for the debt, default or miscarriage of another shall be valid, without a written memorandum, stating the consideration and signed by the party to be charged therewith."

It will be noticed that in each of the paragraphs cited, in order to make the contract valid, it is not necessarily to be signed by both the parties, but only the one to be charged therewith. For instance, if the contract were in the form of letters, in which the plumber offered to furnish all labor and material for an operation for a stipulated amount, and the owner had consummated the agreement with an unqualified acceptance, either letter would prove a sufficient memorandum to bring the contract within the requirements of the Statute of Frauds, the particular one depending on which party to the contract was to be charged therewith. If the plumber were sued

on the contract, his signed offer would be the memorandum required, while if the plumber sued for the contract price the owner's letter of acceptance would be the signed memorandum required by the Statute of Frauds.

Analyzing Section No. 1 it will be seen that any contract for the sale of land *or any interest in land,* to be binding must be in writing and signed by the party to be charged therewith, or his agent, duly authorized in writing. This, of course, refers to the party who agrees to purchase the land as well as to the one who agrees to sell, but so far as the scope of this work is concerned, the plumber is not interested in the purchase end of the agreement. Owing to the fact, however, that many operations in large cities are conducted by dummies, or nominal agents, it behooves the plumber to know their right to act, and be sure that where an interest in land is concerned, the person signing the contract has a power of attorney duly sealed, acknowledged and recorded with the register of deeds of that county. For example, to explain the section, assume that a builder has been empowered to sign contracts for certain work with sub-contractors, but has no power of attorney to sell or convey an interest in land. Suppose, then, that this agent agreed to give as purchase money one of a row of buildings to the plumber, in return for his doing the plumbing work in all the row. Such a contract could not be enforced, for the agent has no authority to sell or convey an interest in land and while if the owner of the buildings was responsible the plumber could recover for the value of the work, he could not recover the building according to the

terms of the contract. Again, suppose the builder agrees to give in return for the work when completed, a first or second mortgage on the premises. Such an agreement would be void because a mortgage is such an interest in land as to bring it within the requirements of the Statute of Frauds.

The second section declaring that no agreement for the sale of goods or chattels of the value of fifty dollars or more will be binding unless some note or memorandum of the agreement is in writing, and signed by the party to be charged therewith, or his duly authorized agent, has two conditions which should be carefully noted. First, while no verbal contract for goods of the value of fifty dollars or more can be enforced, the plumber is not without a remedy at law. He cannot set up a promise to pay an amount of say $200 in return for material furnished and work performed, but he can bring action to recover that amount as the actual value of the work performed. Where there is no express agreement as to the price to be paid, the rule of law is Quantum Meruit—as much as he deserves, or the value of the work and materials.

The second condition has reference to the appointment of the agent. In this respect there seems to be an exception to the general rule that to sign a certain document, the agent must be authorized by a written document of equal dignity with the one to be signed. That is, in order to sign written contracts, the agent would have to be authorized by a document in writing, and to affix a seal to a document, the agent would have to be authorized by a written power under seal. In the case under consideration, however, the agent

need be only "duly authorized." For instance, a salesman for a jobbing house might, and probably would, be engaged orally; yet, having been "duly authorized" he can sign orders or contracts to deliver thousands of dollars worth of goods, so long as he acts within the scope of his authority, and the contract would be valid and enforceable.

The third section cited in the Statute of Frauds is of particular importance to plumbers, for ignorance of its provisions may lead to heavy losses when he believes himself most secure. Read again the provision: "No promise to answer for the debt, default or miscarriage of another shall be valid without a written memorandum stating the consideration and signed by the party to be charged therewith." Take for instance the case where the plumber not caring to trust a certain individual, asks security for the payment of his contract price before beginning work. Some friend or relative of the owner comes to the plumber and says "I understand you will not do Blank's work without security. What's the matter? He's all right. You go ahead and put in the plumbing and if he doesn't pay you, I will." That looks secure enough and the plumber fulfills his part of the contract only to find that the owner can't pay and the surety will not, and safely hides behind that provision of the Statute of Frauds, which requires any agreement or promise to answer for the debt, default or miscarriage of another to be in writing.

But assume that the plumber insists that the promise to pay be in writing, and the surety writes and signs an obligation like the following:

"PHILADELPHIA. PA., Aug. 25th, 1910.

MR. HENRY LEADER, Plumbing Contractor.

Dear Sir:—I understand you will not do the plumbing work in Blank's house without your contract price being guaranteed. I have known Blank for a long time and feel sure you will not lose anything by the contract. You may go ahead with the work and in case he does not pay you, I will.

HARVEY B. RIVERS."

Again the plumber feels perfectly secure, only to find on default of both parties that he cannot recover payment from the surety, Harvey B. Rivers, because the memorandum in writing does not state a *consideration.* Two things to bear in mind therefore is, that when a person agrees to go security for the debts of another, the agreement *must be in writing,* and *must state the consideration.* A form of surety which would be perfectly secure and binding would be a brief statement, such as follows:

"PHILADELPHIA, PA., August 25, 1910.

Greeting:—Know all men by these presents that I, Harvey B. Rivers, in consideration of one dollar in hand paid and other valuable considerations, the receipt of which I hereby acknowledge, pledge myself, my estate, heirs and assigns and agree to pay unto Mr. Henry Leader, the contract price for the plumbing in the residence of August Blank, in case the said Blank should neglect, refuse, or fail to pay the said contract price, upon completion of the work.

HARVEY B. RIVERS."

In some states the Statute of Frauds only requires a promise to answer for the debt of another to be in writing, but does not require the consideration to be stated; notwithstanding this, it is well always in all agreements to state the consideration.

As was previously suggested, it will pay the plumber wherever he may be to familiarize himself with the provisions of the Statute of Frauds of his state, as well as the lien laws of his commonwealth.

Form of Contract.—A contract may be a very formal document prepared with due deliberation after all the terms have been fully considered, or, as is more often the case, it may be a specific tender and and unqualified acceptance. In this connection it is well to point out that if the acceptance is not unqualified, there is not a valid contract. For instance, if the plumber writes:

"Philadelphia, Pa., August 21st, 1910.

Mr. August Blank.

Dear Sir:—I will furnish all material and labor, according to the plans and specifications, for the plumbing work in the residence you are building on the corner of 12th and Houston Streets, for the sum of Six Hundred Dollars ($600.00).

Respectfully submitted,

Henry Leader."

and Mr. August Blank replies:

"Philadelphia, Pa., August 22, 1910.

Mr. Henry Leader.

Dear Sir:—I herewith accept your offer of the 21st inst. to furnish all material and labor according

to the plans and specifications for the plumbing work in my new residence, Twelfth and Houston Streets, for the sum of Six Hundred Dollars ($600.00).

August Blank."

The two letters form a binding and valid contract which will be enforced in any court having jurisdiction. If, however, Mr. Blank sends a qualified acceptance like the following:

"Philadelphia, Pa., August 22d, 1910.

Mr. Henry Leader.

Dear Sir:—I hereby accept your offer of the 21st inst., to furnish all material and labor according to the plans and specifications for the plumbing work in my new residence, Twelfth and Houston Streets, for the sum of Six Hundred Dollars ($600.00), provided you will include the gas fitting for this price.

Yours very truly,

August Blank."

there would be no contract because there was not an unqualified acceptance. Instead the offer has been met by a counter offer and the contract can only be consummated by an unqualified acceptance by the plumber of the tender made by the owner. If, taking that letter for an acceptance, as he was willing to throw in the gas fitting, the plumber went ahead, ordering material for the work and incurring other expenses without notifying the owner, he would have no redress for the owner's actions, if, considering his counter offer was refused, the owner gave the contract to some other plumber.

The owner might accept the terms but stipulate that half the contract price be paid in 60-day notes;

or there might be some other condition which he would like to incorporate, *but* no matter what the condition might be, it prevents the consummation of the contract so long as it remains unaccepted by the plumber.

Another point to remember is that once an offer like the foregoing is accepted, payment is not due until the contract is completed in its entirety, unless stipulated otherwise in the specifications. Therefore, in the absence of a payment clause in the specifications, it is well for the plumber to state in his offer the manner in which he would like payments made.

In order that the contract be binding, the offer or tender must be specific. The plumber must unqualifiedly offer to do that which is accepted. If through excessive caution, or with a view of opening negotiation he should make a tentative offer such as:

"PHILADELPHIA, PA., August 21st, 1910.

MR. AUGUST BLANK.

Dear Sir:—I have carefully studied the plans and specifications for your new residence, Twelfth and Houston Streets, and believe I can put you in a first class job of plumbing for Six Hundred Dollars ($600.00). I trust, therefore, that you will favor me with the work when you are ready to let the plumbing contract.

Respectfully submitted,
HENRY LEADER."

and the owner should send an unqualified acceptance, it would not consummate a contract enforceable against the plumber, for he has not specifically offered

to do the work for that sum. His belief that he can profitably perform the work for six hundred dollars is not an offer to do so.

The following form of contract is a copy of the uniform contract adopted and recommended for use by the American Institute of Architects and National Association of Builders. It is well, however, in preparing a contract for signatures, to avoid printed forms. Usually they contain some provision which is objectionable and had better be left out. A printed form may be used as a guide, however, and a typewritten copy prepared incorporating whatever sections or articles are considered desirable and omitting those which are objectionable or which are not clearly understood as affecting the terms of the agreement under consideration. When a printed form is to be used, sometimes the intention is to cross out objectionable articles by drawing lines through them; but, by an oversight, the objectionable sections are not eliminated before signing and those remain, retaining all their validity.

UNIFORM CONTRACT

Adopted and Recommended for General Use by the

AMERICAN INSTITUTE OF ARCHITECTS

and the

NATIONAL ASSOCIATION OF BUILDERS

This Agreement, made the.....day of.....in the year one thousand nine hundred and.....by and between .....party of the first part (hereinafter designated the Contractor), and.....party of the second part (hereinafter designated the Owner),

Witnesseth that the Contractor , in consideration of the agreements herein made by the Owner , agree with the said Owner as follows:

ARTICLE I. The Contractor shall and will provide all the materials and perform all the work for the.....as shown on the drawings and described in the specifications pre pared by.....
Architects, which drawings and specifications are identified by the signatures of the parties hereto, and become hereby a part of this contract.

ART. II. It is understood and agreed by and between the parties hereto that the work included in this contract is to be done under the direction of the said Architects, and that their decision as to the true construction and meaning of the drawings and specifications shall be final. It is also understood and agreed by and between the parties hereto that such additional drawings and explanations as may be necessary to detail and illustrate the work to be done are to furnished by said Architects, and they agree to conform and abide by the same so far as they may be consistent with the purpose and intent of the original drawings and specifications referred to in Art. I.

It is further understood and agreed by the parties hereto that any and all drawings and specifications prepared for the purposes of this contract by the said Architects are and remain their property, and that all charges for the use of the same, and for the services of said Architects, are to be paid by the said Owner.

ART. III. No alterations shall be made in the work except upon written order of the Architects; the amount to be paid by the Owner or allowed by the Contractor by virtue of such alterations to be stated in said order. Should the Owner and Contractor not agree as to amount to be paid or allowed, the work shall go on under the order required above, and in case of failure to agree, the determination of said amount shall be referred to arbitration, as provided for in Art. XII of this contract.

ART. IV. The Contractor shall provide sufficient, safe and proper facilities at all times for the inspection of the work by the Architects or their authorized representatives; shall, within twenty-four hours after receiving written notice from the Architects to that effect, proceed to remove from the grounds or buildings all materials condemned by them, whether worked or unworked, and to take down all portions of the work which the Architects shall by like written notice condemn as unsound or improper, or as in any way failing to conform to the drawings and specifications, and shall make good all work damaged or destroyed thereby.

ART. V. Should the Contractor at any time refuse or neglect to supply a sufficiency of properly skilled workmen, or of materials of the proper quality, or fail in any respect to prosecute the work with promptness and diligence, or fail in the performance of any of the agreements herein contained, such refusal, neglect or failure being certified by the Architects, the Owner shall be at liberty, after three days written notice to the Contractor , to provide any such labor or materials, and to deduct the cost thereof from any money then due or thereafter to become due to the Contractor under this contract; and if the Architects shall certify that such refusal, neglect or failure is sufficient ground for such action, the Owner shall also be at liberty to terminate the employment of the Contractor for the said work and to enter upon the premises and take possession, for the purpose of completing the work included under this contract, of all materials, tools and appliances thereon, and to employ any other person or persons to finish the work, and to provide the materials therefor; and in case of such discontinuance of the employment of the Contractor .....shall not be entitled to receive any further payment under this contract until the said work shall be wholly finished, at which time, if the unpaid balance of the amount to be paid under this contract shall exceed the expense incurred by the Owner in finishing the work, such excess shall be paid by the Owner to the Contractor ; but if such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the Owner . The expense incurred by the Owner as herein provided, either for furnishing materials or for finishing the work, and any damage incurred through such default, shall be audited and certified by the Architects, whose certificate thereof shall be conclusive upon the parties.

ART. VI. The Contractor shall complete the several portions, and the whole of the work comprehended in this Agreement by and at the time or times hereinafter stated to wit:

ART. VII. Should the Contractor be delayed in the prosecution or completion of the work by the act, neglect or default of the Owner, of the Architects, or of any other contractor employed by the Owner upon the work, or by any damage caused by fire or other casualty for which the Contractor .....not responsible, or by combined action of workmen in no wise caused by or resulting from default or collusion on the part of the Contractor , then the time herein fixed for the completion of the work shall be extended for a period equivalent to the time lost by reason of any or all the causes aforesaid, which extended period shall be determined and fixed by the Architects; but no such allowance shall be made unless a claim therefor is presented in

writing to the Architects within forty-eight hours of the occurrence of such delay.

ART. VIII. The Owner agree to provide all labor and materials essential to the conduct of this work not included in this contract in such manner as not to delay its progress, and in the event of failure so to do, thereby causing loss to the Contractor , agree that.....will reimburse the Contractor for such loss; and the Contractor agree that if.....shall delay the progress of the work so as to cause loss for which the Owner shall become liable, then.....shall reimburse the Owner for such loss. Should the Owner and Contractor fail to agree as to the amount of loss comprehended in this Article, the determination of the amount shall be referred to arbitration as provided in Art. XII. of this contract.

ART. IX. It is hereby mutually agreed between the parties hereto that the sum to be paid by the Owner to the Contractor for said work and materials shall be..... subject to additions and deductions as hereinbefore provided, and that such sum shall be paid by the Owner to the Contractor , in current funds, and only upon certificates of the Architects, as follows:

The final payment shall be made within..... days after the completion of the work included in this contract, and all payments shall be due when certificates for the same are issued.

If at any time there shall be evidence of any lien or claim for which, if established, the Owner of the said premises might become liable, and which is chargeable to the Contractor, the Owner shall have the right to retain out of any payment then due or thereafter to become due an amount sufficient to completely indemnify.....against such lien or claim. Should there prove to be any such claim after all payments are made, the Contractor shall refund to the Owner all moneys that the latter may be compelled to pay in discharging any lien on said premises made obligatory in consequence of the Contractor default.

ART. X. It is further mutually agreed between the parties hereto that no certificate given or payment made under this contract, except the final certificate or final payment, shall be conclusive evidence of the performance of this contract, either wholly or in part, and that no payment shall be construed to be an acceptance of defective work or improper materials.

ART. XI. The Owner shall during the progress of the work maintain insurance on the same against loss or damage by fire,..... the policies to cover all work incorporated in the building, and

all materials for the same in or about the premises, and to be made payable to the parties hereto, as their interest may appear.

ART. XII. In case the Owner and Contractor fail to agree in relation to matters of payment, allowance or loss referred to in Arts. III. or VIII of this contract, or should either of them dissent from the decision of the Architects referred to in Art. VII of this contract, which dissent shall have been filed in writing with the Architects within ten days of the announcement of such decision, then the matter shall be referred to a Board of Arbitration to consist of one person selected by the Owner , and one person selected by the Contractor , these two to select a third. The decision of any two of this Board shall be final and binding on both parties hereto. Each party hereto shall pay one-half of the expense of such reference.

The said parties for themselves, their heirs, successors, executors, administrators and assigns, do hereby agree to the full performance of the covenants herein contained.

In Witness Whereof, the parties to these presents have hereunto set their hands and seals, the day and year first above written.

In Presence of

Whatever form of contract is signed, it should be scanned thoroughly first and if there is anything objectionable, or which the plumber does not understand, he should insist that it be stricken out before signing. When all the conditions governing payments, progress of work, abandonment, arbitration and the like have been incorporated in the specifications, a plain, simple memorandum in writing, stating that the plumber agrees for a certain sum to furnish all work and materials, according to the plans and specifications, and the owner agrees to pay him for the service the stipulated sum, signed by both parties, is all that is required and is the best form of contract to use.

Release from Contract.—Once a contract has been formally entered into, either by a specific offer

and an unqualified acceptance, or by the signing of an agreement, drawn up in due form, it becomes binding on both parties, and neither can be absolved from the terms without a release from the other party. In this respect, a verbal agreement is of no value, for the document releasing the party to a contract must be of equal dignity to the contract itself. That is, if the contract is simply a written contract, a written release is all that is necessary; whereas, if the contract is under seal, the release must be a written document under seal. Further, there must be a consideration for the release. Both parties to a contract are presumably mutually benefitted by the contract, and if one seeks to be released from his obligation, the other party is entitled to some compensation for the release. In other words, having entered into a formal contract, another formal contract, for a consideration, is required to release either party.

Conditional Sales.—A fact well worth knowing by the plumber is that in the eyes of the law, plumbing fixtures, so called, are not really fixtures in the sense that when they are set in place they become annexed to and part of the freehold. On the contrary, under some conditions, they may be treated like furniture and furnishings, and sold under a conditional bill of sale, or chattel mortgage, the same as a sewing machine, piano, or other article of furniture. This is true in New York state and no doubt in other states where there are similar laws in relation to chattel mortgages, and it will pay the plumber to look into the matter in his neighborhood.

In order to take advantage of this condition, however, the plumber must know how to proceed to protect himself. Suppose, for instance, that some builder about whose credit he is uncertain wishes him to do the plumbing work in a certain building. Without running much risk, he can take the contract, provided the work is divided into the two main divisions, roughing and fixtures. The roughing work will be the only risk. This must be a *separate* and *distinct contract* of the ordinary form, having no relation to the fixtures. As the roughing work is comparatively inexpensive, the plumber does the work and collects his pay. Then for the fixtures, *and before they are delivered on the operation,* he must prepare a contract under the terms of which he furnishes all fixtures and connects them up in place for a certain price, the title to the fixture to remain vested in him until final payment is made. This document must be recorded in the office of the City Clerk, Registrar of Deeds, or whatever office is designated by law for this purpose, and the plumber is then perfectly secure, for until final payment has been made on the goods, they remain his property and can be removed should the owner fail to live up to the terms of the agreement. It must be borne in mind, however, that as between the plumber and a subsequent purchaser or loaner, his claim will not be valid if he fails to record it according to law. The following form of contract will be found binding for this purpose:

"Memorandum of agreement, entered into this 24th day of August, 1910, between Henry Leader, party of the first part, and August Blank, party of

the second part. The said party of the first part agrees to and with the said party of the second part, to furnish, set in place, and connect with water and waste pipes, all the plumbing fixtures, so called, consisting of water closets, bath tubs, lavatories, sinks, water heaters and tanks, as called for in the specifications, in the five-story flat building now in the course of erection on the south east corner of 120th street and Morningside Avenue, New York City, and belonging to the party of the second part. And the said party of the second part, in consideration of the above mentioned work and material, agrees to pay unto the party of the first part, his heirs or assigns, the sum of Three thousand dollars ($3,000) lawful money of the United States, when the contract is completed and the work passed or approved by the Department of Plumbing, and final report made. It is expressly understood and agreed between the parties to this contract: First, that the contract relates solely to the furnishing and fitting-up of fixtures, the so-called roughing being the subject matter of another agreement.

Second: That the fixtures, so called, are not fixtures in the sense that they become attached to the property, but are furniture or furnishings.

Third: That all right, title and interest in the fixtures shall remain vested in the party of the first part until final payment has been made and that in default of payment, the said party of the first part without formality of law, may enter the premises at any reasonable hour of the day and remove the said fixtures and their connections.

Fourth: That nothing but cash shall be deemed payment within the meaning of the contract.

(Signed) HENRY LEADER,
AUGUST BLANK.

It is well in a case of this kind where the documents must be recorded, to have it attested by a notary public and subscribed to by at least one witness. In case the notary's seal and witness' signature are not necessary, they will not invalidate the contract, and, to make sure, when the plumber is in doubt, he should have it, both witnessed and attested. Having complied with all these formalities, he should then record the agreement in the proper office *before beginning work on the contract.*

Signatures to a Contract.—The signatures to a contract must be *subscribed,* that is, they must be placed at the bottom of the contract and are usually placed at the lower right hand side. In case a person cannot write, his mark will be sufficient, provided it is witnessed by a third person and his name is written near it in the customary way and by a duly authorized party. One party to a contract cannot write, "by mark" the name of the other party to the contract.

When an agent signs a contract, the plumber should make sure that he signs it for—and so as to bind, his principal. To do so, he would have to sign:

"August Blank"
"by Albert Factor, Agent."

If he were to write his signature:

Albert Factor, agent for August Blank"

the contract would not be binding on August Blank,

for the agent has signed the agreement with his own name, the clause "Agent for August Blank" merely serving in the eyes of the law as a means of identifying or explaining what Albert Factor is party to the contract.

Tenders for Work.—The privilege is commonly reserved in all public work of rejecting any or all bids, and this has led to the common belief that in all work the contract must be awarded to the lowest bidder. Except in a few cities or states where it is made compulsory to award all public work to the lowest responsible bidder, the mere estimating on work and tendering a bid imposes no obligation whatever on the owner, who can reject any or all bids, or accept the lowest, highest or any other tender, without in any way being liable. The bid tendered by a plumber in competition with others, is simply a specific offer and unless there is an unconditional acceptance, there is no contract and no cause of action. Further, the owner is under no obligation to specifically reject the offers he does not accept. His neglect to accept them operates as a rejection.

Extra Work.—An article is generally incorporated in every specification, or if omitted there, is included in the contract, stipulating that no extra work shall be paid for unless ordered in writing. The courts of the various states view this condition in different lights, some holding that it is useless for parties to try to tie up by contract their freedom to deal with each other; while in other states, the courts refuse to admit parol evidence to establish a claim for extra work, holding them to the terms of the contract and

requiring that written orders be produced on which to base the claims for compensation for the extra work performed. At the best, such a clause if not lived up to opens the door for expensive litigation, and as the proverbial ounce of prevention is worth a pound of cure, it is a wise policy to insist on written orders for all extra work, when ever a clause requiring such procedure is incorporated either in the specifications or contract. A good plan to pursue, one which will save after-disputes, as to the cost of extra work, and perhaps prevent expensive litigation, is to have a schedule of prices affixed to every specification or contract, stipulating just what each item entering into the makeup of a plumbing installation will cost, in case of extra work. This may take the form of a table or itemized list of all sizes of pipes, lead, wrought and cast iron, fittings of various sizes, oakum, lead, fixtures such as are called for in the original specification, labor, excavating per foot, etc. The cost of these various items has been already worked out and, after allowing the profit desired, the net costs to the owner can be stipulated so that he will know before hand what the extra work and materials will cost.

Acceptance of Work.—The making of final payment for a contract, the written acceptance by the owner, or the certificate of the architect, does not always operate as a full acceptance of the work and discharge of the contractor from the terms of his contract. If, after final payment is made, omissions, or the substitution of inferior goods are discovered, the contractor can be held to the terms of his contract, as

though no certificate had been issued and no payments made. An erroneous opinion seems to prevail among contractors that the moving into a building and using the fixtures operates as an implied acceptance of the work. Such is not the case, however, and whether the owner has moved in or not, if the terms of the contract have not been lived up to, specific performance can be enforced by the courts. Nothing acts as an acceptance of the work, except the Statute of Limitations, when the terms of the contract have not been lived up to, and whenever the deviation from the terms of the contract are discovered, the completion of the contract, according to the original agreement, can be enforced.

Time Limit on Contracts.—When no set time has been stipulated for the completion of a contract, the plumber cannot exercise his own sweet will and complete the work whenever he pleases. In the absence of an express understanding, as to the time when a contract must be completed, the law assumes that the intention of both parties was to have the work done within a reasonable time; and what that reasonable time should be is a question for the jury to decide. Sometimes a time limit is set in the contract and a clause calls for the payment of a certain sum of money per day to the owner for each day over and above that set in the time limit. But even without this clause, the owner can recover for loss, damages or injury due to delay by the contractor. The law as laid down by the highest court of Michigan, and which no doubt will be followed by other states, is expressed in the following rule:

"Even though there should be no stipulation in the contract to the effect that the contractor was to forfeit a certain sum as liquidated damages, for each and every day the work should remain unfinished, beyond the specified time, the owner would be able to recover, as damages, any loss he could bring evidence to prove actually existed through the default of the contractor."

On the other hand, should delay in the completion of a contract be caused by the owner, or those acting for him, unless the right to postpone or delay the work were expressly stipulated in the contract, the plumber could recover damages for any loss he sustained or additional expense he was put to by the delay. In case no loss or damage resulted, he would at least be entitled to an extension of time, equal to that delay caused by the owner. In order to avail himself of the extension of time, and possible damages, for the delay of work, the plumber should notify the owner in writing, as soon as he found his progress stopped, and should protest against the delay as it prevents him from fulfilling his contract according to the terms and was entailing additional expense (which he might explain) on account of the delay.

Penalties and Premiums.—In a contract, the stipulation is generally made that a certain sum per day shall be paid the owner as liquidated damages, for every day the contract remained unfinished beyond the stipulated time. Whether the condition can be enforced by the courts, depends always on whether the payment is to be made as a penalty, or as liquidated damages. If the court finds that the payment

is in the nature of a penalty the condition cannot be enforced, for the penalizing or punishing of a person by penalty, is the prerogative of the state through the courts. If, on the other hand, the condition is construed to be in the nature of liquidated damages, that is, the mutual understanding of the contracting parties, as to the exact loss that will result from a failure to complete the work at the stipulated time, the condition will hold good and be enforced by the courts. Even though the courts hold that the condition imposes a penalty, it does not relieve the contractor for he is still liable for damages for the delay caused. The only difference is, that in case the condition is held to be a penalty, it throws the question open for the jury to determine just what the loss or damage was that was sustained by the owner. Of course, if the amount of liquidated damages as stipulated in the contract were low and reasonable, the contractor might fare worse by having it construed as a penalty, than if he allowed it to stand as liquidated damages, for a jury might find that the real loss to the owner exceeded the amount of the liquidated damages stipulated.

In order to avoid uncertainty as to the intention of the parties, and make sure that the amount stipulated shall be construed as liquidated damages, not as a penalty, the contract is often drawn with a stipulation providing for premiums and liquidated damages. That is, the contract stipulates that for every day the work on the contract is completed before a certain time, the contractor shall receive from the owner, as premium, a certain sum per day; and, conversely, for every day exceeding that time that the work re-

mains unfinished, he shall pay to the owner, an equal sum as liquidated damages. Such an agreement is generally enforceable as drawn.

LAW OF INSURANCE

There are two conditions regarding insurance, which the plumber must consider when he engages in business. The first is, to cover his stock, furniture and fixtures with a policy of insurance. This is necessary in many cases where the contractor seeks credit, for many supply houses will not extend a line of credit to plumbers who do not keep the goods covered by insurance. Outside of this requirement of supply houses, the plumber should cover his goods for his own satisfaction and safety, and in order that he will not be called upon to pay for insurance which does not insure, it will pay him to submit his policy to a lawyer for an opinion as to its many printed terms. As was previously pointed out in this work, signing a printed form of contract is a hazardous undertaking, and an insurance policy is no exception to the rule. Many conditions are printed in the form of policy used, which will prevent the plumber recovering in case of fire. unless they are stricken out before signing the contract. For instance, owing to a printed stipulation, most policies are void if gasoline is used or stored on the premises. There are very few plumbing shops where gasoline torches or gasoline furnaces are not used, and these would invalidate the policy of insurance so that in case of fire nothing could be recovered. Further, many policies contain a stipulation rendering them void in case the interest

of the plumber is not whole and entire. Under the terms of such a policy, if the plumber had goods in his shop on consignment, or materials of any kind in which others had an interest, the policy would be void.

The second consideration is for the plumber to see that work on new buildings, when of sufficient size to warrant it, is covered by insurance. If a loss is sustained by fire, before final acceptance of the work and payment, the loss is the plumber's, and he must again install the work, according to the terms of the contract, even though the loss entailed would make him a bankrupt. Insurance, then, both for the shop and the work should be looked after by the plumber, and he should make sure that no clause in the policy of insurance will deprive him of his indemnity in case of fire.

LEASES

The principal condition for the plumber to guard against when signing a lease, is a condition calling upon him to keep the premises in repair and at the expiration of the lease to surrender them in as good order and condition as when received, usual wear and tear excepted. The condition is usually worded something like the following:

"And during the said term will keep the premises in good condition, order and repair, and at the termination of said term will deliver up the said premises in as good condition, order and repair as the same now are, reasonable wear and tear excepted."

The trouble with a lease containing an innocent clause like the foregoing, lies in the fact that if destroyed by fire, earthquake, tornado, flood or other agency, the lessee cannot deliver them up in as good condition and repair as they are when he leases them, without rebuilding. And that is just what the courts insist upon him doing. A contract to repair, according to law, is a contract to rebuild. And in case of damages from any cause, outside the acts of God or the public enemy, the lessee will have to repair the premises and put them in as good condition as when he took possession, even though in order to do so, he had to rebuild the premises. It is possible that in most courts, damages from earthquakes, might excuse him, and possibly, but only possibly, a windstorm or tornado.

All such responsibility, however, can be avoided by insisting that the section be made to read:

"And during the said term will keep said premises in good condition, order and repair, and at the termination of said term will deliver up the said premises in as good condition, order and repair, as the same now are, reasonable wear and tear and damages from accidental fire, or other causes beyond the control of the lessee, excepted."

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