greater than in Fig. 3, the horse's weight at the collar acts through the line P W. The weight is supported at O, and, as against the resistance P 3, acts along the line P O.

Thus, with the high angle trace the lines P W and P O approach each other, and the trace line P 3 approaches the position in which a force applied at the end of a lever acts to the greatest advantage, namely, normal to or at right angles to the lever. These diagrams may be sufficient to show the importance of a low angle trace and a short trace. Of the value of a low attachment there can be no doubt, but, as already stated, it is desirable to have the action of a high attachment for level and good roads, so that the pull on

Fig. 5

the collar may always be the least, and even in some cases so that the pull takes some weight off the horse's feet.

When Mr. Brigg first brought out an attachment for automatically effecting this, he attached to the fore carriage of any four-wheeled vehicle an apparatus as shown in side elevation in Fig. 7. Here the shafts, instead of being pivoted at B, are so mounted that their point of rotation is carried down to C. The traces T are connected to hooks on a cross bar at E, the cross bar being supported by end links which are pivoted at F. The traces pull against a cross-leaf spring connected with E, but for explanatory purposes we here show in the diagram a spiral spring at S. Now it will be seen that the traces pull through the spring, and so long as the road is good and level and the resistance offered by the vehicle is within the power of the spring S, the trace will pull through the line T S, and the shafts will rest as in the ordinary way, supported by the harness at G. As soon, however, as the vehicle enters upon a hill the pull necessary to haul the vehicle is increased, the spring S is overpowered and the link E F comes into contact with the heel of the shafts at B. Now the shafts and the pieces B C being converted into

Fig. 6

rigid structures by the stay D, the pull upon the trace and the pressure of the piece E F on the heel of the shafts at B causes a downward vertical pressure upon the saddle strap at G, and this downward pressure will be proportional to the resistance of the vehicle. Thus, instead of taking weight off the horse's fore feet when going up a hill, and when he requires it most, he has this weight returned to him; and not only this, the weight which is thus usefully given him is taken off the fore wheel and the draught of the vehicle thereby lightened.

Here we have, then, the equivalent of the action explained with reference to Fig. 1A. The results of the application of this attachment were, it is stated, very satisfactory, but further study of the subject showed that a better result could be obtained by even more simple means. In the apparatus, Fig. 7, the pull is always that of a horizontal trace until the resistance is greater than that of the spring S, or until the bar F E actually bears against B. For the heavier pulls up to this point it is desirable that the virtual line of draught should be lowered somewhere between E and C. With the apparatus shown this could not be done, and moreover that part of the weight of the shafts

FIG. 7

which is supported at G is never lessened or removed from the horse's back, and this with the heavy shafts of many wagons is in itself sufficient to cause a considerable part of a horse's fatigue. To secure the desired end and to overcome these objections, Mr. Brigg has devised the apparatus shown by Fig. 8. This consists of a pair of springs attached by a simple clamp to the fore carriage and to the shafts. The strength of the spring is proportioned to the weight of the shafts, to the position of the point of attachment of the traces, and to the upward lift which it is desired to put upon the belly band.

The amount of this upward lift can be varied by the clamp attachment, which allows of adjustment of the position of the spring in its unloaded position. The action of this apparatus, it will be seen, is to exercise

always a lifting effort upon the belly band. This, it would seem, is undesirable, as removing weight from the horse's feet, whether on level ground or on a hill, and though generally desirable on the level, it is the reverse on a hill. The result of this, however, is that a low angle of trace can be adopted with very great advantages, and a very variable virtual angle of draught is secured. To explain. In Fig. 9, suppose the line A B to represent a horizontal trace, and at the same time the pull of a horse in both direction and magnitude, and B C to represent the lift by the springs in Fig. 8. Then the virtual line of draught will be in the line B D, a very satisfactory direction when the resistance of the vehicle is comparatively

Fig. 8

small, and the horse may, therefore, advantageously get all possible relief.

When the resistance to traction increases to that shown by the length of the line A B, Fig. 10, the lift B C remains the same, but is relatively smaller, the virtual angle of draught is lowered to D B. Thus the angle of draught varies with the resistance. In each of these cases the attachment of the traces at D would have the same effect as is brought about by attachment at A and the lift B C—that is to say, then, so long as the pull is along a line A B, Figs. 9 and 10, some of the weight of the horse would be taken off the horse's feet, even when going up hill, which is undesirable. When going down hill the best limit of angle would be theoretically that which would carry the horse, and when going up hill the best angle would be that which enabled the horse to receive on his back as much of the load as should under any circumstances be put upon it.

Now, by means of the low attachment with the same pull as in Fig. 9, and the same lift B C by the springs, the virtual angle or line of draught in Fig. 11 is brought down to zero or to a horizontal line, a good line for a moderate resistance. With a still lighter pull, as at A

B, Fig. 12, the virtual line of draught is raised to D B, taking more weight off the horse's feet; but when the load becomes as heavy as represented by A B in Fig. 10, the virtual angle of draught with the low-down attachment, as at Fig. 13, is brought down below the horizontal, as at D B, and the lifting effect B C is not only neutralized, but there is a downward pressure brought to bear on the back band equal to B E. It will thus be seen that by means of this attachment the virtual angle of draught is automatically brought into correspondence with the resistance to traction.

Very numerous examples of the application of the principles underlying this question of virtual line of draught might be appealed to, as, for instance, the use in modern London coal wagons of high front wheels, and the practice with all carter's of getting as much of the load on the front wheels as possible; the different ways in which navvies load their barrows when going down or going up hill, and the different angle at which men wheeling trucks put the handles on different roads. There are also other points which might be explained with regard to the attachment described, but sufficient has already been said to explain its action in the most salient respects, and to show its importance.

With this apparatus, as with other things, the proof rests with practical working, and as to this, it may be mentioned that the Great Northern and other railway companies have had vans fitted, and the effects on the horses noted for some months in widely separated towns. The experimental trials showed that the horses were able to take a greater load than before with much less fatigue, and that they increased in weight. The result is that the Great Northern company has decided to have other vans fitted.

GAS LEAKAGE.*

By CHARLES H. NETTLETON.

By the term leakage I mean the difference between the gas registered at the station meter and the amount for which we make out gas bills, plus the quantity consumed at works, offices, etc., in other words, the unaccounted-for gas.

* Read before American Gas Light Association, New York, October, 1891.

The causes for the difference between the gas we make and the gas registered by consumer's meters are numerous, and some of them I propose to consider at length.

Temperature.—One of these causes over which we can have but little control, and to which I think but little attention has been paid, is the difference in temperature at which the gas is measured at the gas works and that at the consumer's meter. A friend of mine tested the temperature of the gas for a year, in New York city, at the station meter of the works in his charge and at the meter in his own house, and the average difference was nearly 16°. In this case the house meter was in the cellar. Allowing for meters kept in warmer places, such as factories, stores, etc., it is probably safe to say that in this latitude the difference in temperature of gas when made and when sold is not far from 10°, and as every 480 feet of gas expands or contracts about 1 foot for each increase or decrease of 1° in the thermometer, it follows that for the estimated 10° the contraction is 2 per cent., so that of our apparent loss of 5 or 10 per cent., about two parts are beyond our control.

Leaks in Mains.—The main source of loss, however, is probably leaks in mains and services.

Thanks to the energy and ability of the men who make our pipe to-day, we have, whether using cast iron, wrought iron or steel, a uniformly good pipe, in using which, with reasonable care, good joints can easily be made. The younger men in the business will never know, unless they happen to use some ancient "special," the annoyance and bad language that were produced years ago, by the spigot end of some fitting being too large for the hub of some pipe of the same nominal size, though both pipe and special, perhaps, came from the same foundry, or when, in regular hub and spigot pipe, the space for a joint was only one-eighth of an inch in width. With such pipe it was very difficult to make good joints, and consequently difficult to keep down the leakage.

I am unable to speak from personal knowledge of the use of wrought iron or steel pipe as mains, but those who have used that kind speak highly of it, particularly in connection with its freedom from leaks. The company with which I am connected have nothing but hub and spigot cast iron mains, and as they, in this section of the country, are used almost exclusively, I propose to confine my remarks to them alone. Owing to the heavy water pressure put upon all cast iron pipes at the foundry where made, the pipes when first purchased are almost certain to be without cracks or holes, and when laid, and the joints well made with either a good soft lead or Roman or Portland cement, one is reasonably sure of having a tight pipe before the ditch is filled.

In regard to material used in making joints; personally, I prefer those made of cement, on the score of much less cost and less liability to leak. A personal experience, which is no doubt familiar to many of you in your own work, will best illustrate my faith in cement joints. In a severe winter, several years ago, the frost had gone down around a six inch gas pipe on a certain street, and a large leak was reported in that neighborhood. On digging up the pipe it was found to have pulled apart three-eighths of an inch where tapped for a three-quarter inch pipe, and a cement hub and spigot joint, less than three feet away, was intact. I think the chances are that with a lead joint the latter would have drawn, and a leak started which would not have been stopped until the "smelling committee" (as named by one of our local papers) had put in its work. But either lead or cement with well driven gaskets makes a first class joint.

The filling of the ditch as far as the top of the pipe is a very important matter, and too much care cannot be taken up to that point. Crooked rammers should be used to pack the dirt firmly and solidly under the pipe, so as to give it as solid a foundation as possible. But in doing this, care is needed, particularly with small pipes, to see that the dirt is not rammed too vigorously, thus raising the pipe out of line and making the first start toward leaky joints. I desire to emphasize this point, as I believe as much, or more, depends on the way the ditch is filled, as on the way the joints are made. Another personal experience may illustrate this.

About twelve years ago, when knowledge seemed to be much larger in quantity with the speaker than at the present time, I had occasion to lay about 8,000 feet of 8-inch pipe. It was rushed through, and the cost per foot was satisfactorily small, the gas was turned on, and tested by means of a meter and valve. To my surprise and mortification the gas was going through the meter rapidly, although not a consumer was on the main. Some of the leaks were soon found and stopped, but the pipe could not be made satisfactorily tight at once. Afterward I found out that in the hurry of getting in so many lengths of pipe per day, in certain sections the dirt had not been properly rammed under the pipe. For nearly three years after it was laid it was a source of great annoyance and expense, but finally, with the ramming that each length received when a leak was repaired, the trouble disappeared and to-day it is as tight as any other length of main under my control. But while the trouble lasted I believe it is no exaggeration to say more than 500 leaks were repaired on that line of pipe. Since that time my attention in laying pipe has been given principally to packing the dirt under and around the pipe.

Kind of Soil.—The quantity of leakage depends to a considerable extent on the character of the soil surrounding the pipes. Given a sandy or gravel soil, and the passage of the gas from the pipe through a hole or a cracked joint is hindered very little by the surrounding dirt; loam lessens the leak materially, and stiff wet clay makes the pipes tight, holes and cracks to the contrary notwithstanding.

In a certain city in which the gas pipes are surrounded by mud, through which the gas cannot be forced by the ordinary pressure, I was told that the leakage was absolutely nothing except the gas lost in making connections with services, laying new mains, etc.

In this connection it may not be out of place to describe the method followed by the speaker in searching for leaks. The gang is made up of a foreman and either eight or ten men. The foreman from his book containing the location of pipes, lays out the line of pipe.

indicating same in any convenient manner. Along this line, when on unpaved streets, a man makes holes every 6 or 8 feet through the crust of the road with some light, pointed iron bar, generally a piece of 1-inch pipe with a steel point at one end.

Following him come six or eight men in couples, each with an 8-pound striking hammer, and each couple with a steel bar about 3 feet 6 inches long, having one end drawn out to a long, sharp, tapering point. In the shallow holes made by the man in advance, these steel bars are driven, each bar being struck by two hammers. When driven from 2 to 3 feet, the distance varying with the known depth of the pipe, the bar is hammered sideways, and then is easily withdrawn by hand. The two men take their bar and go forward immediately to drive another hole.

Following these is another man whose sole business is to smell at the openings made by the bars, and then fill in the same with loose dirt, reporting all leaks to the foreman.

On paved streets, the same bar is used for a short distance to separate the paving blocks, and then a smaller bar is driven down to the main. So much difficulty was found, however, in withdrawing the bars on paved streets, that to save time a tool was made which, while crude, works well. A heavy bar with jaws on one end is used as a lever, a piece of hard wood cut on its edge into steps, the latter shod with iron plates, is used as a fulcrum, and the bar pried out. This simple device nearly doubled the amount of work that could be done on paved streets with a given amount of labor, as compared with withdrawing the bars by hand.

The above system is the result of many experiments through a series of years, and while it may not answer in all places, yet with the soil in my neighborhood, which is largely sand and gravel, it works very well.

Services.—With leaks in services, I have had very little experience; but I am told that in older companies than mine, and in those where the soil rusts wrought iron quickly, this is a large source of loss.

It is said that this destruction can be prevented by coating the pipe with one or more preparations, but of that I cannot speak of my own knowledge. Certainly, if troubled from this source, I would try to see that the services were so coated that little or no rust would form.

Consumers' Meters.—Another cause of unaccounted-for gas is the errors in consumers' meters, for which I think the only remedy is periodical testing. If a company does not test its meters for years, some of them are bound to get out of order, the bellows gradually lose their oil, do not expand to their full capacity, and the meters run fast, or the bellows are cracked, the valves or their seats wear unevenly, and the meter runs slow.

The fast meters, when they become fast enough, are sure to be heard from, by reason of complaints from consumers, are brought in, tested, and correct meters substituted; but the slow meters are rarely heard from, generally not until they fail entirely to register. In this way, and for these reasons, a company failing to test its meters will in time have a large majority running slow; and I am confident, after testing all my meters a number of times, and knowing how many run fast and how many run slow, even when repaired every three or four years, that it is only a question of a few years before 7 per cent., or even more, of all gas sent out would become "unaccounted for" by reason of slow consumers' meters.

This is one reason, but not the only one, why it pays to test meters periodically.

Station Meters.—Another cause of loss is an incorrect station meter. How general this I am unable to say, but more than once when hearing some wonderful tale of big yields per pound I have wondered if the station meter on which these results were based was correct. I have heard it stated that very large yields and very large leakage were quite apt to go together. But in this matter, as in many others, it is very easy to deceive one's self, and tests should be made occasionally to demonstrate the fact that the meter is approximately correct.

The following table has been prepared with care, and gives the results obtained at the works in my charge for the past 10 years:

Year Ending.	Gas Sent Out.	Unaccounted For.	Per Cent.	Miles of Pipes, Approximate.	Sent Out per Mile per Year.	Lost per Mile per Year.	Total Cost of Searching & Stopping Leaks.	Cost per Mile per Year.	Yield per lb. of Coal.
Apr. 1, '82.....	20,503,040	1,879,083	9.1	9.4	2,181,174	199,902	\$862 23	\$91 72	4.72
" '83.....	24,331,210	2,007,518	8.2	10.6	2,295,397	189,368	273 21	25 77	4.90
" '84.....	27,770,260	2,659,308	9.5	11.8	2,353,412	225,365	285 64	24 21	4.87
" '85.....	26,471,990	2,216,838	8.3	12.2	2,169,835	181,708	481 20	39 36	4.93
" '86.....	28,332,044	1,496,123	5.3	14.3	1,981,262	104,624	395 63	27 66	4.92
" '87.....	30,107,386	1,539,296	5.1	14.8	2,034,350	104,006	609 79	41 20	4.74
" '88.....	32,268,912	1,533,448	4.6	15.3	2,174,439	100,225	22 74	1 48	4.91
" '89.....	34,851,118	1,859,938	5.3	15.8	2,205,767	117,718	531 04	33 61	4.89
" '90.....	38,910,268	1,679,948	4.3	16.7	2,329,956	100,595	243 42	14 57	4.85
" '91.....	43,001,890	1,154,021	2.7	16.9	2,545,490	68,285	370 61	21 93	4.77

The first column is the gas sent out for the several years, as stated.

The second column, the unaccounted-for gas expressed in feet.

The third column, the unaccounted-for gas expressed in percentage of the total sent out.

The fourth column, the miles of pipe. I regret to say that the figures for the first few years are not absolutely accurate. The errors, however, I believe to be slight. The figures for the last four years are correct.

The fifth column, gas sent out per mile of pipe per year.

The sixth column, the loss per mile of pipe per year. This probably expresses leakage in the fairest way possible, for the purpose of comparison with other works; and yet given a works with a consumption of 10,000,000 per mile, and the loss due to difference in temperature at which gas is measured at works, and in consumers' houses, would probably be nearly 200,000 feet per mile. For the average sized works, however, under 100,000,000 per year, and sending out between 1 and

1½ and 3 millions per mile of pipe per year, I suggest that no fairer basis of comparison can be made than the feet lost per mile per year.

It was suggested a few years since that the size of pipe ought to be considered; that on a 12-inch pipe the chances of a leak were just double that on a 6-inch, owing to the greater area of pipe and joint. But all smaller works will average about the same sized pipes, and to figure everything to a basis of say 4 inch pipe is a refinement that, in my judgment, is uncalled for. I am quite well satisfied that for small works 100,000 to 150,000 feet per mile per year should be considered a reasonable amount of leakage, and unless the circumstances were exceptional, a manager should not rest satisfied until that figure was reached.

Seventh and eighth columns give total cost and cost per mile respectively of searching for and stopping leaks. These columns are added to add general interest to the table, and in the hope that the discussion will bring out the fact that the costs stated are above or below the average cost in other places.

I desire to call your attention to the fact that in the year ending April 1st, 1888, but \$22 was charged to leakage, but in the year following, quite a large amount was spent, and yet the leakage increased, showing the lack of attention in the previous year.

The ninth column is added so that it cannot be suggested that if the yield per pound of coal had been given the table might have assumed a different appearance. It is but fair to state that these yields are reached after adding 2 per cent. to the weight of coal carbonized. Your attention is called to the lower yield for year ending April 1st, 1891, and the small leakage in the same year. I think it is entirely probable that if the yield for the last year had been larger, that the unaccounted-for gas would not have been so small as reported.

In closing this paper I venture the opinion that, like many lines of work, it requires only patience and perseverance to make a success with the leakage problem.

Regular attention, the same we give to our manufacturing operations, through a series of years, will certainly bring the desired result. But when once reduced it will not do to assume that the leakage will remain small; the laws of nature are constantly working in a way that must produce leaks sooner or later, and if no attention be paid to mains for two or three years the leakage will surely increase, no matter how small at the commencement.

I heard one of the best known and most successful lawyers of this country say, that the conditions of success in his profession were a good stomach, a willingness to work, and a very moderate amount of brains. However much one may be inclined to take the remark, *cum grano salis*, as applied to the legal profession, there can be no question as to its truth when applied to successful work on leakage.

A good stomach—health to attend to the work, and strength to do it.

A willingness to work—industry and perseverance, a determination to reach the goal you have set for yourself, if work will accomplish it.

A moderate amount of brains—I have yet to discover the need of any considerable ability in trying to reduce leakage. We are all, the brightest man and the dullest, on about the same level when it comes to the treatment of this question.

Work, and work alone, is nearly all that is required. "Eternal vigilance is the price of liberty." Everlasting effort the price of small leakage.

BRONZING.

MR. FREDERICK BUEHRING, a practical writer of considerable experience, gives the following useful advice upon the subject of bronzing:

The printing of an underground or foundation color for bronzing is generally regarded by printers as a very simple process, requiring less experience and care than any other printing; they find a reasonable excuse therein that all ink will be covered with bronze, therefore they think it will make no difference what color is printed under the bronze or in what condition it is; but in this they are mistaken. Printing the foundation color for bronzing requires just as much experience as and even more than any other printing. Printing on

a regular book or writing paper of an underground for bronzing is not so very difficult as on the various enameled papers, but there are some points connected with it that require attention. There are three facts which have to be observed under all circumstances: First, that we want solid bronzing; second, that we want to show the bronze in its natural clean or pure appearance; and, third, that we want the highest gloss on it. To obtain a perfect solid bronzing, it is necessary that the ink should be in a condition to print solid and to hold the bronze so that it cannot be dusted off when the impression is dry. To obtain the bronze in its natural color it is absolutely necessary to print a foundation color which is in harmony with the color of the bronze itself. To obtain the highest gloss it is necessary that the impression should be printed smoothly, solidly, and with no more ink upon the rollers than is absolutely necessary. Now, how shall we attain all that is required? Of course, we speak first only of bronzing on well-sized book or writing paper.

For an underground for gold bronze there is a color in the market that can be bought in any lithographers'

or printers' supply house under the name of gold size. This, mixed with No. 2 varnish for reducing, is perfectly adapted to the purpose; but large establishments, which have their own grinding mills and want to grind the color themselves, may take two parts of burnt sienna and one part of chrome yellow, ground with No. 3 varnish, all in a very stiff condition, and mixed afterward to the right consistency for printing with No. 2 varnish. For silver bronze this size would not do, as the color has too yellowish an appearance, which destroys the original silver color, and this should not only be avoided, but the color improved as well. The so-called silver bronzes are a composition metal, and are far from having a silver-like appearance. Therefore use twenty parts heavy white and one part of milori blue, ground as above with No. 3 varnish and mixed with No. 2 varnish. For copper and crimson bronze use pure sienna, with a trifle of red Vienna lake, ground and mixed as above. For nickel or genuine silver bronze use only heavy white, ground and mixed as above.

The foregoing will be sufficient for printing on book or writing paper, but on enameled or glazed papers there are sometimes many difficulties arising from the poor quality of the paper. Enameled paper is manufactured in four different grades: First, with a glossy appearance (glazed paper); second with a lower gloss (gloss paper); third, with a trifle of a gloss (half glazed paper); and, fourth, without any gloss and with only a smooth and dull enameled coating (plated paper). The color for the glazed paper must be entirely different from that for enameled paper, thus: The glazed paper with its very glossy appearance has a hard gloss surface and requires very little ink. Only No. 3 varnish should be in the ink, and a little copal varnish should be mixed with it, as the ink remains on the surface without soaking into it; the lightest touching will rub the ink off and spoil the work; copal varnish prevents this. Paper with a lower gloss requires the same as above, but less copal varnish. Half glazed paper should be printed with No. 2 varnish in the ink; ink for enameled paper without any gloss should be mixed with No. 3 varnish. In cold winter days No. 2 varnish would also answer, but no thinner varnish should be mixed with the ink at all, as the thin varnish soaks into the paper in a few seconds and no varnish will remain on the surface to hold the bronze. On the highest glazed steel blue paper only No. 4 varnish should be used in warm summer days and No. 3 varnish in the winter.

All these directions will apply if the paper is in a good state and fit for printing; but, as has already been said many times in regard to enameled papers, not all papers have a good coating of enamel to stand the manipulations above mentioned, and when the paper is poor it will peel off through the adhesiveness of the ink and the stiff varnishes, and here is where the printer gets into difficulties. Strong ink should be used, otherwise the bronze will not stick; but strong varnish makes the poor paper peel off and the impressions are spoiled thereby. Mixing thin and stiff varnishes would not answer the purpose, any more than the mixing of a thin and a stiffer varnish would make a medium varnish, as many printers think. One will always have a mixed ink with thin and a stiff varnish, and the result is the same; the thin varnish will soak into the paper and the stiff varnish will make the paper peel off, and a medium varnish will not hold the bronze on the impression. Printers have experimented in many different ways without good results. Of course, the fault was with the paper, but this does not alter the case. The paper, poor as it was, had to be printed. Some printers who could not control the adhesion of the bronze and the peeling off of the paper resorted to mixing tallow in ink with stiff varnish, thinking this would help. They calculated that the stiff varnish would hold the bronze and the tallow make the ink soft enough, so that the paper would not peel off; but they failed, as tallow has the quality of keeping the ink fresh for all time, so that the bronze can be wiped off again and will never dry properly. Now, how to overcome this difficulty as well as possible. The first thing, of course, is always to keep stiff varnish in the color and no thin varnish whatever. Now mix as much lavender oil as necessary with the ink. This softens the ink and prevents peeling off, but use no more of it than is absolutely necessary. Begin with a trifle and add more gradually until you see that the paper does not peel off any more. Lavender oil is better than tallow, as it softens the ink more, but evaporates again, and therefore, the ink will dry as quickly as without it. But here comes another question: If the work on the stone is very fine and close, too much lavender oil would spread out the fine lines and make the work look smutty and indistinct. If there is fine line work only on the stone, the paper would not peel off so easily and it could be printed without lavender oil. A slow speed on the steam press would overcome the difficulty in that case; but very often there are solids and fine work together on the stone, and here we have to use other means. Take two parts of No. 2 varnish, two parts of Venetian turpentine, and one part of yellow beeswax; melt these and mix them thoroughly with the ink. This, preserved in a covered tin box, will keep good for many years and will never get a skin on top or lose anything of its good qualities. An enameled paper which has not enough coating on and where the fiber of the paper shows through the printing should not be used at all.

The use of magnesia powder for rubbing over the tints of colors already printed is obsolete and does not answer the purpose, neither does the soapstone occasionally used as a substitute. Instead, mix your colors or tints with any gloss varnish to be obtained in lithographic supply houses. They will then dry quickly, offer a smooth surface, and thereby prevent the bronze from sticking.

Another method, which will answer the same purpose and at the same time involves the saving of at least one printing where several colors are to be used, is the following:

The most desirable paper for this process is the enameled, but a well calendered and sized book paper will answer when the printing ink is mixed accordingly.

Suppose that a show card, label, or anything similar is to be printed in seven colors, say silver, gold, yellow, red, blue, black, and flesh color. (It is not meant that only these colors and no others can be used.)