

TR
920
R4

UC-NRLF



B 3 141 333

YB 24288

Mining dept.

LIBRARY
OF THE
UNIVERSITY OF CALIFORNIA.

Class

The
Preparation of Drawings
and Other Illustrations
for Photo-Reproduction

REINHARDT



Mining Dept.

Mining dept.

LIBRARY
OF THE
UNIVERSITY OF CALIFORNIA.

Class

551
R 369

The Preparation of Drawings and Other Illustrations for Photo-Reproduction

BY

CHAS. W. REINHARDT

Chief of Drafting Department, *Engineering News*

Author of "Technic of Mechanical Drafting," "Lettering for
Architects, Engineers and Draftsmen."

(Reprinted from *Engineering News*, February 15, 1906)

PRICE 25 CENTS

NEW YORK
THE ENGINEERING NEWS PUBLISHING CO

TR 920

R4

MINING DEPT.

Mining Dept.

TO THE
LIBRARY



The Preparation of Drawings and Other Illustrations for Photo-Reproduction.

There is probably no other adjunct to the making of technical literature which is so little understood and so carelessly handled as the preparation of the necessary text illustrations. And yet a great many publications depend for their principal value upon the illustrations which accompany the text matter. It therefore follows that poorly rendered illustrations will detract not only from the appearance, but also from the usefulness, of a book or paper, as compared with illustrations neatly and clearly executed, correctly drawn as to details and legibly lettered.

For the reproduction of line drawings many authors and publishers resort to the so-called "wax engraving process." Here the original, either a tracing, or a blue-print, or pencil sketch on detail paper, is photographed in the desired size upon the sensitized waxed surface of a copper plate. The outlines of the drawing are then scratched through this wax enamel down to the blackened copper backing by means of different sized gravers. The lettering on such a drawing is set up in type and stamped into the softened wax. The finished wax engraving is "electrotyped," the film-like copper covering on the wax mold is backed with type-metal, mounted "type-high," and is then ready for printing.

The wax engraving is considered by numbers of technical men as the very acme of perfection, since the lines print clean and sharp and the let-

tering is legible. Such illustrations certainly have a smooth and finished appearance, but they are to a large extent routine copies of poor originals, with more or less liability of errors and omissions, as every line must be ruled in by hand and all the lettering must be reproduced by setting type and impressing it in the wax. Since it is easier to get superficially passable results from a poor drawing by means of the wax process than by the processes to be described later, there is perhaps more likelihood that poor material for il-

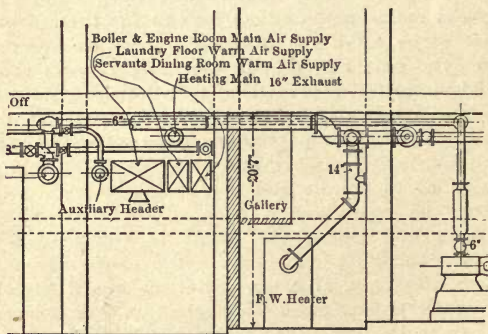


Fig. 1. Facsimile Reproduction of Wax-engraving.

ustrations will be used for the wax than for the other processes. The clear, even lines and uniform, legible lettering of the wax engraving cover a multitude of sins and give rise to many illustrations which are of little use for purposes of careful study. This is most likely to be true when the illustrations are complex. For simple line drawings and diagrams the wax process has much to commend it, especially where the services of good draftsmen are not available.

When an author or publisher wishes to make sure of a facsimile reduction of as perfect a line drawing as is needed for his purpose, he will have it reproduced by photo-lithography or by photo-engraving on zinc. Photo-lithography is generally employed for making large-sized illustrations for folding sheets and insets, which cannot very well be handled economically by the ordinary printing press. The originals require the same finish as those used for the zinc process. The photographs, reduced to the desired size, are transferred to a polished lithographic stone, which, after being re-etched, is ready to print from in the lithographic press. Original photographs may also be reproduced in this way, giving the same general result as by the more familiar half-tone process, described further on.

A line engraving on zinc is produced by first printing a reversed negative, made from a large original, upon a polished and sensitized zinc plate. When inked by means of a printing roller, the ink adheres to the black lines of the plate, corresponding to those on the original drawing. Powdered resin is then sprinkled over the plate. It adheres to the ink lines, and on being heated it melts and forms a protective coating against the etching solution. This solution is next poured over the plate and is allowed to remain until it eats out enough of the metal between the lines to leave the latter in clear relief. More metal is then removed or "routed" from between the lines by means of a finishing tool. Finally, the zinc plate is mounted upon a wood block and is ready for use in the printing press.

The process thus briefly outlined requires in the way of original drawings pure black lines on a clear white or bluish-white background. The medium upon which to draw may therefore be white

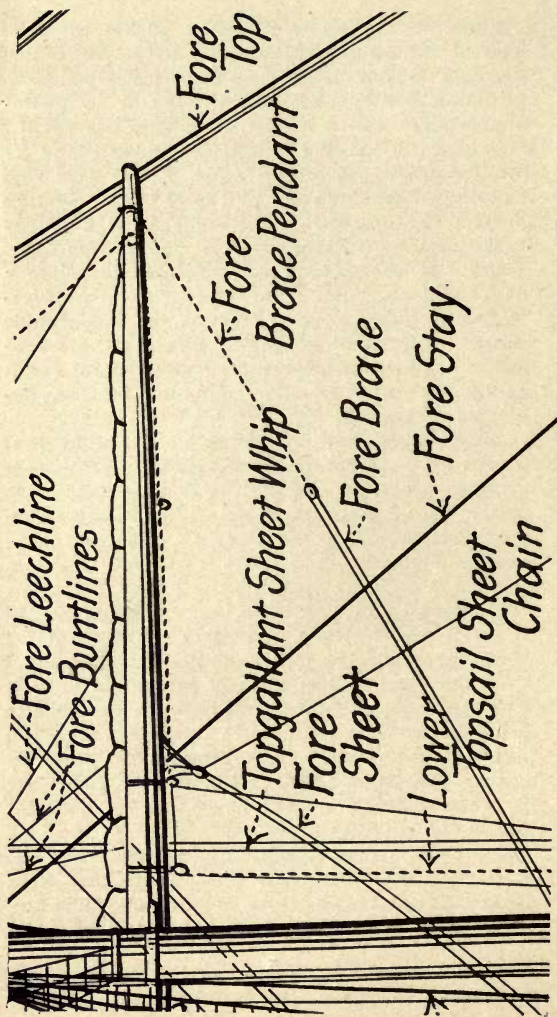


Fig. 2. Portion of Original Drawing made for $\frac{2}{3}$ reduction; actual size.

paper, tracing paper or transparent vellum. Buff colored paper has sometimes yielded fair results, but its use is not advisable. It must be remembered from the very outset that the drawing is to be made for a certain amount of reduction, generally large, and that consequently it must be made so that when reduced its details will still be recognizable, its lines still separated from each other, and, above all, lettering and descriptive symbols must be readily legible.

The reductions to which drawings are subjected may vary all the way from "one-half" to

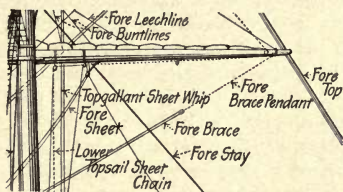


Fig. 3. Reproduction from Fig. 2.

"nine-tenths"; that is to say, from one-half to one-tenth the original size (linear measure). An easy reduction to work for may be called the "two-thirds" reduction, or to one-third the linear measure of the original. The lines in such a drawing will have to be neither too bold nor too fine, and the lettering may be made of moderate size. As stated above, the draftsman must know from the very outset the rate of reduction and must proceed accordingly, always having in mind, for instance, that for a two-thirds reduction his lines must be three times the width of those on the final proof taken from the finished plate. This rule, however, need not be carried out rigidly, because fairly fine, black lines, having a ridge of ink on top, will always possess a value

in photographing, and will consequently be recorded upon the negative. Some draftsmen are in the habit of screwing up the nibs of the ruling pen tightly, so as to produce a fine line. The result is that the ink is squeezed out beneath the points and a gray, very fine line will result, which will either not photograph at all or come out only in spots. Therefore, it is advisable never to try to introduce too fine lines into any drawing, and it is necessary to make sure that all lines are perfectly black.

When working for reduction a drawing should always be presented in its essential details; all unnecessary center-lines, invisible and construction lines, as well as dimensioning, should be omitted. In order to make clear the construction of whatever object may have to be presented, a certain amount of outline shading, very boldly executed, may prove of great value. The shading should be heavy and decisive, the shade-lines being five or six times as heavy as the ordinary outlines. The draftsman must be quite sure in his own mind as to what parts must "stand out," as, also, what portions should be shown as receding, and shade accordingly.

Center-lines should be shown the strength of ordinary outlines. The neatest symbol, and most suggestive perhaps, is the "dash and dot" line, with regular spacing between, showing dashes shorter than is customary at present. Invisible and construction lines should only be employed where clearness demands their use; short dashes will answer very well for that style of lines. Dimension lines in a well executed drawing should be the least prominent of all, and should therefore be shown in very short light dashes or dots, leaving open spaces for the dimensions themselves. In this way the solid outlines of the

drawing are not in any way interfered with; the eye takes in at a glance the object itself; all auxiliary lines are thus made of secondary importance.

Additional clearness may at times be gained by introducing a few touches of curved surface shading, where such will aid the understanding of a certain shape, which perhaps is not otherwise

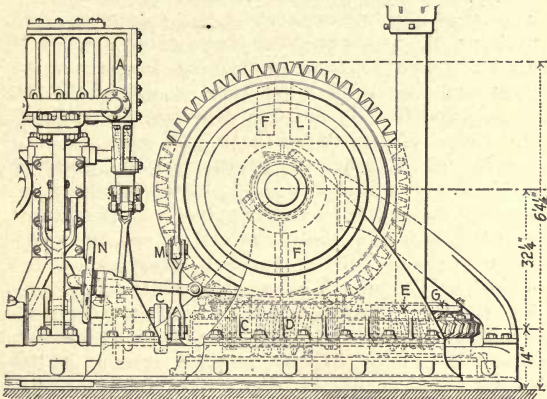


Fig. 4. Reproduction of portion of drawing, where all hidden parts are carefully outlined in broken lines, which, nevertheless, do not interfere with the "visible" outlines. All unnecessary center-lines are omitted.

made clear by any other view. Such shading, where properly executed, will greatly improve the appearance of a drawing, but is unfortunately often used indiscriminately, and in such cases detracts from the clearness of the illustration. In the style of shading there is a special tendency for the draftsman to use too close a spacing. Where portions of a view are to appear in section, the proper section-lining should conscienti-

ously be used, being quite sure that all such parts are properly designated in this way. Parts shown in elevation should under no circumstances receive any such ruling; a very rigid distinction should always be made between parts in section and parts in elevation by the use of correct sectioning in the former only.

The lettering of a drawing which has been finished up to that point must again be put in with a view of purely supplementing the drawing, and perhaps the accompanying text matter. It should all be placed so that it may be read from the base and the right-hand side of the sheet. A proper distribution of such descriptive matter in the shape of notations, titles and numerals will wonderfully enhance the appearance of a drawing—the reverse also holds good. There should be no attempt to crowd dimensions, reference letters or small notes into their respective spaces where such are too small. Instead, they should be placed boldly outside or opposite, as the case may be, and dotted reference lines used, with arrow-heads attached. This rule should be adhered to especially where there is no great amount of lettering used, so that in such a case the outlines of the figures are permitted to stand out clearly and distinctly by themselves. The style of lettering used depends, of course, greatly upon usage and individual preference; but no lettering for reduction work can compare in legibility and rapidity of execution with the so-called one-stroke Gothic lettering, either inclined or vertical. The inclined style can with advantage be used for all purely descriptive matter, dimensions, notations, etc.; the upright lettering will naturally commend itself for sub-captions, reference letters and main divisions, which ought to be emphasized. The so-called "all-cap" lettering requires more time to

construct, and is not so readily legible as the "cap-and-lower-case" lettering, which latter style has for those reasons come into almost universal favor. Main titles or captions for any reproduction can cheaply and neatly be set up in type; therefore the construction of such by hand on any drawing for photo-reproduction is nearly always useless and expensive. Underlining of lettering is undesirable, as it tends to distract attention from the outlines of the drawing itself. As the one-stroke lettering is supposed to be drawn in uniform strength of body, a specific mode of procedure becomes necessary—the direction of strokes and their sequence ought to be carefully studied by every draftsman.

The different reductions to which a drawing may have to be subjected require, of course, different sizes of lettering, and well worn pens of different makes can be used to produce just the requisite strength of body for the letters, with one application for each stroke, for it goes without saying that the strength of the body of the letters must be in accordance with their respective sizes. For lettering on a drawing above a "five-sixths" reduction (i. e., to be reduced to one-sixth its original length), a stiff, red sable brush can be used with advantage. In order to be legible to the average reader, the lettering on any reproduction should not come out smaller than uniformly one millimeter high in the small lower-case letters, such as "a," "e," "m," "n," for instance. The other letters must, of course, show in proportion. Therefore the lettering on an original, which, for example, is to be reduced three-fourths (i. e., one-fourth its present length) must be made in the small lower-case letters mentioned four millimeters high, with strength of body in proportion. A drawing thus lettered up and exe-

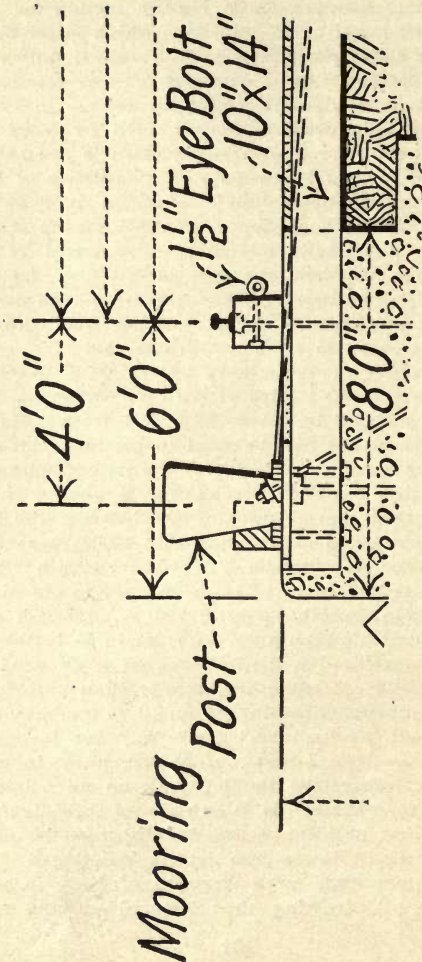


Fig. 5. Portion of Original Drawing made for somewhat more than $\frac{1}{2}$ reduction; actual size.

cuted will, of course, stand a much greater reduction and yet show legible and clear; nevertheless, the standards given here have been followed where absolutely good work has been essential. Corrections and erasures should be very carefully made, as the brownish tint so often noticeable on tracing-cloth where erasures have occurred will show on the negative obtained by photographing, and must be attended to separately. Such places can be covered up by painting Chinese white over the spots affected.

Very often the reproductions are overloaded with non-essential details, every center-line being shown, the dimension lines all ruled in solid, and a mass of almost illegible lettering being spread

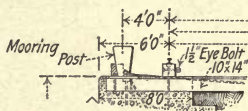


Fig. 6. Reproduction from Fig. 5.

over the whole illustration. The reader of such illustration is put to considerable trouble to interpret the drawing; he has to make his own deductions, read between the lines, as it were, and often gives up the task in disgust. All this is caused by reproducing an unsuitably drawn and lettered illustration, almost useless, at the best; certainly not serving as an ornament to the publication in which it appears.

There is no reason why many original drawings cannot be made so bold, in both lines and letters, that instead of having the originals blue-printed in the ordinary cumbersome way they could simply be photographed down to perhaps one-fourth their length. Portfolios containing such reduced original drawings of the Pittsburgh Filtration

Works and of the recent improvement of the New York Central R. R. appear exceedingly handy and serviceable, and are certainly far superior to the unwieldy and at times almost unmanageable roll of blue-prints, which otherwise have to be handled.

It may be mentioned as a curiosity that sometimes pencil-drawings on tracing paper have given good results in reproduction; the pencil

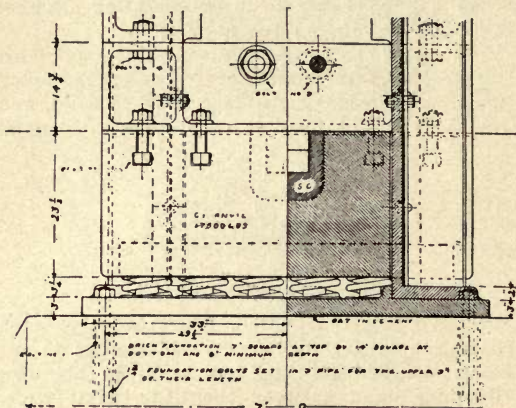


Fig. 7. Facsimile Reproduction from original unsuitably drawn and lettered.

lines were evidently black enough to possess some value in the exposure.

Occasionally it becomes necessary to reproduce an illustration taken directly from some book, pamphlet or periodical. Such a reproduction can, of course, not be reduced very much, and from the outset of such operation it must be determined just how much reduction it can "stand." The outlines of the illustration to be reproduced can with some care be retouched where ragged

or broken. The principal part to be amended, though, on such a sheet is the lettering, which

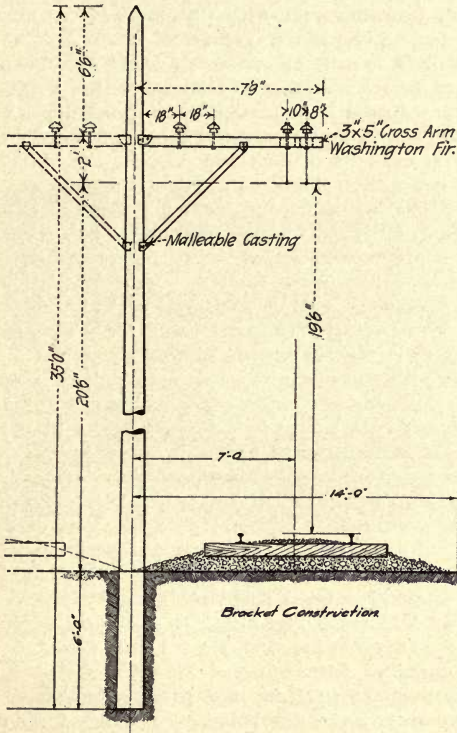


Fig. 8. Reproduction; upper portion remodeled for further reduction; lower part left untouched so as to show difference in appearances.

as a rule is poorly done and much too small. Such portions of the lettering as are essential can be pasted over with slips of white paper and the

parts re-lettered to the right size upon the paper; the portions not wanted may be obliterated by simply painting over with Chinese white. The dimension lines, which generally were drawn as solid lines, can be cut up with a brush or a fine pen dipped into a solution of Chinese white, so as to produce dotted lines to designate dimensions. The center lines, likewise, can be cut up into regularly spaced, small dots and dashes; the invisible or construction lines can either be painted out altogether or similarly treated. Where outline shading is absent on reproductions, such shading may sometimes be added, if the paper possesses a fairly good surface. Such a remodeled drawing shows up very well in the proper reduction, and can be made fully as serviceable for purposes of study as a well-executed original drawing.

Half Tone
Process

The principles of the so-called "half-tone process" are similar to those governing the making of line-engravings, with the exception that the original, consisting either of wash-drawing or a photograph, is photographed through a screen. The impression recorded on the sensitized plate thereby is a number of opaque dots of varying size, the white sections of the original assuming the largest size, the dots growing smaller in the darker portion until they are completely lost in the solid blacks. The effect is a picture in dots, the varying shades and tints being depicted by various sized dots.

The impression from the reversed negative is taken upon a highly polished, sensitized copper plate, which, after repeated etchings, is ready for the wood mounting. The finishing of such a plate consists in local re-etching, a procedure which will diminish the size of the dots in places, making them print lighter in the finished picture. At times the dark or black portions may have to be "pol-

ished" in, the fine white dots in such places thereby being obliterated, so that these portions will print perfectly black. Where repeated local re-etching fails to do justice to the high lights shown in the original, such parts may boldly be engraved out by a skillful finisher, so that they may print absolutely clear white.

If a highly finished picture is wanted, exhibit-

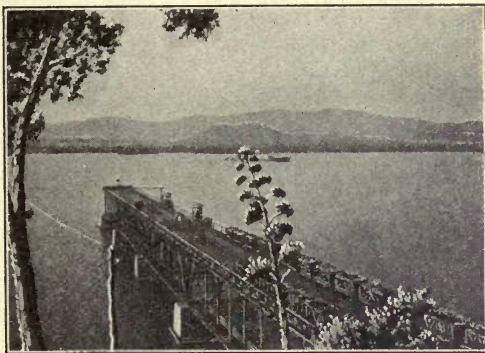


Fig. 9. Specimen of retouched half-tone; coast in distance is accentuated purely by outlines; steel pier in intermediate distance is also strengthened by light outlines, whereas foliage in foreground received the highest lights and deepest shadows.

ing high lights and deep shadows, or where the judgment of the finisher is not exactly trusted, resort must be had to retouching the original photograph. On the ordinary brown or solio prints the high lights are painted in with pure Chinese white, or the same mixed with vermilion, so as to somewhat match the tone of the photograph. Deep shadows are produced by lamp-black with a trifle of vermilion added. Solid

blacks can be effected by the use of India ink. The purpose arrived at in all cases is, of course, to somewhat exaggerate the contrasts, as the interposition of the screen in photographing the original will have a tendency to reduce values and more or less flatten the tints. At times the contours of an object shown may be so shadowy against the background that a little outlining in a light neutral color may be all that is required. Such outline may sometimes be done effectively

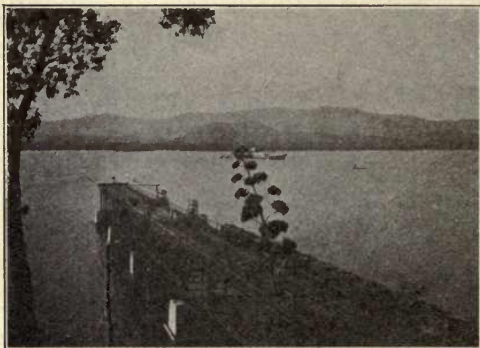


Fig. 10. Shows original of Fig. 9 un-retouched.

in a slightly lighter color, where dark surfaces adjoin. Nowadays some beautiful work is being done by professional retouchers with the aid of the air-brush, which is worked by compressed air. The illustrations for modern trade catalogues, with their magnificent cloud backgrounds, are nearly all prepared by means of the air-brush.

Most photographs will be found to have a glazed or polished surface, which will not receive water colors readily. In such cases the surface can be

gone over gently with an ordinary artist's rubber, taking care not to cause any streaks or scratches. At times some rubbing with the tip of the finger to which a little powdered pumice has been applied, may be effective upon refractory portions.

Retouching of "Velox" prints can be done with neutral colors without any admixture of vermilion or brown. Here the black generally needs reinforcing. On dull Velox prints some good



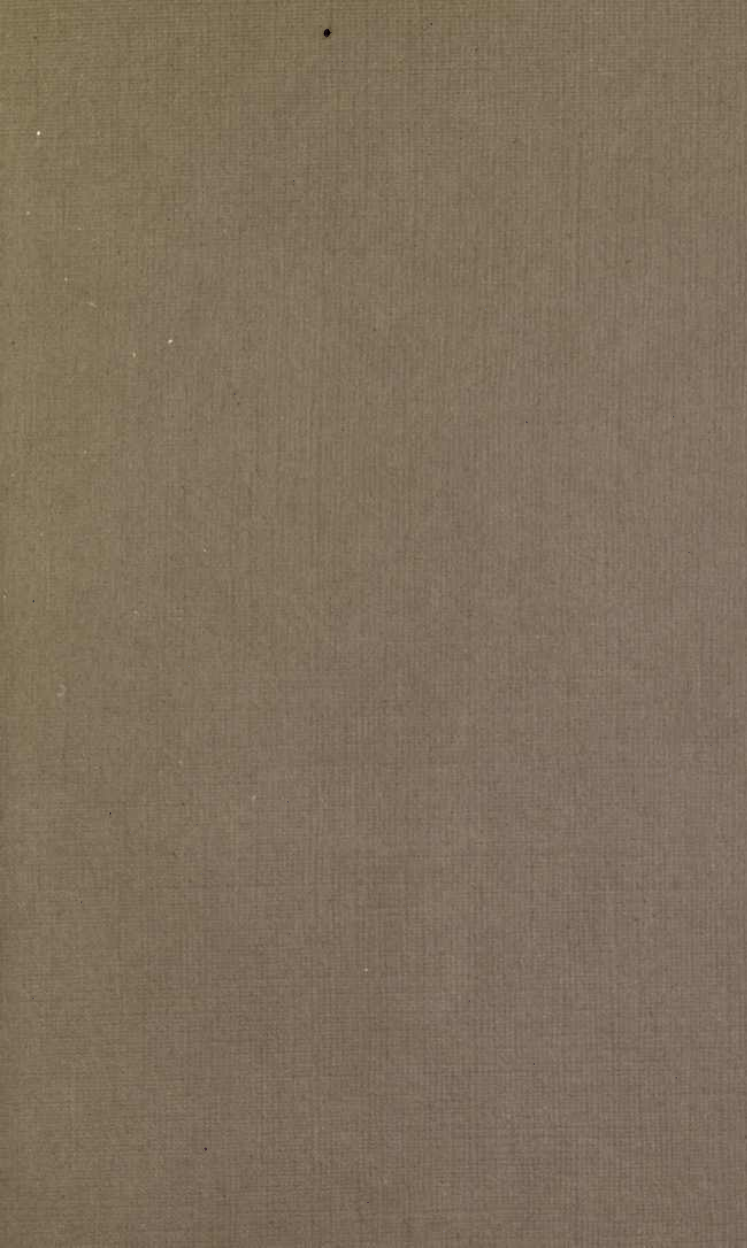
Fig. 11. Reproduction from half-tone; screen does not match properly.

work can sometimes be done with an ordinary H. B. drawing pencil.

As occasionally reproductions from line-engraving can effectively be "doctored up," so also proofs from half-tones may be prepared for a new reproduction. The proofs cut from magazines or trade-papers can be mounted, and where judiciously retouched will give very good results. The only difficulty which engravers generally encounter in this class of work is the matching of their screen upon the screen which the original contains. If this cannot be done correctly a peculiarly mottled effect upon the surface of the new plate will result.

Sketching from Photographs

At times it may become desirable, for one purpose or another, to entirely redraw an unsatisfactory small illustration, or to make a pen-and-ink sketch from a photograph. In such a case a "silver-print" enlargement is made from the original; the silver-print is mounted and is ready for drawing. The light-brown tint of such a print permits of distinguishing the lines drawn upon it; only the absolutely necessary outlines should be drawn upon the print with waterproof ink; parts which ought to be amended or points to be preserved and nevertheless to be modified in execution can be drawn on in pencil. After this has been done the print is bleached in an enameled pan with a bichloride of mercury solution, the application of which will cause the photographic color to disappear, leaving only the pure white paper, with black ink, or occasional pencil outlines upon it. After rinsing in clean water the print is ready to continue with when dry. Such a drawing can be finished in the style advocated above; a pen-and-ink sketch can be executed purely in black and white, following the technic observed in an etching, or a newspaper illustration. Small mistakes can be rectified by painting over with Chinese white. A good rule to follow is to draw general outlines on such prints sufficiently heavy, as the reflection of the pure white background upon the black lines will have a tendency to make them appear too narrow in photographing. As a rule, all pen-and-ink portraits for periodicals are made in this manner. A drawing upon a bleached silver-print should never be exposed very long to bright light, as otherwise the original brownish tint of the print will begin to reappear, a matter which would make a good photo-reproduction of the drawing impossible.



ENGINEERING NEWS REPRINTS

A Series of Reprints of some Articles of more permanent value in Technical Work that have appeared in ENGINEERING NEWS. ::

UNIFORM SIZE: 4½ x 7 ins.; FLEXIBLE PAPER BINDING
PRICE, 25 CENTS EACH

- No. 1. Ignitions and Explosions in the Discharge Pipes and Receivers of Air Compressors. By ALEX. M. GOW, M. E. 20 pages, one page diagram.
- No. 2. The Structural Design of Towers for Electric Power-Transmission Lines. By JOSEPH MAYER, M. Am. Soc. C. E. 27 pages, 3 illustrations.
- No. 3. The Design of High Abutments. By WM. M. TORRANCE, M. W. S. E. 13 pages, 12 figs. (including folding plates).
- No. 4. The Preparation of Drawings and Other Illustrations for Photo-Reproduction. By CHAS. W. REINHARDT, Chief Draftsman, *Engineering News*. 20 pages, 11 illustrations.
-
-

YB 24288

TRE

920

R4

224500

Reinhardt

Mining Dept

