pure colors and tints and shades of the same, put together in simple designs, so as gradually to embrace the first principles of color, and then advance to more complex designs, according as he finds that he can introduce the results of subtler observation and practice. The marked want of success in the production of neat designs in very low goods is attributable to a great extent to a want of knowledge and experience in combining colors according to the laws and relations we have indicated. Apart from the demands of any special department of trade, the student must master these relations of color to one another in imaginary designs. To one wishing at once to apply colors in a manufacturing process, this course may seem roundabout and slow; but it will enable the apprentice ultimately to work with confidence and avoid loss in the manufacture of goods. In order to prevent any misconception of the diagrams (Nos. 1 and 2, which we reproduce from our last issue), we will give the relations of contrast and harmony, which are based upon the primary, secondary, and tertiary colors. Just as the relations between yellow and purple in No. 1 diagram and those between citrine and purple in No. 2 diagram were combined in the text relations, so we shall combine the red and green relations of No. 1 diagram and the green and russet relations of No. 2, and so on with the blue and olive relations which have orange in contrast:

HARMONY: Reds and russets.
CONTRAST: Greens.

No. 1 DIAGRAM.	{ Purple Red... Orange Red... Red... Russet... Orange Russet... Purple Russet... }	= { ...Yellow Green. ...Blue Green. ...Pure Green. ...Pure Green. ...Olive Green. ...Citrine Green. }
-------------------	---	--

HARMONY: Blues and Olives.
CONTRAST: Oranges.

No. 1 DIAGRAM.	{ Purple Blue... Green Blue... Pure Blue... Pure Olive... Green Olive... Purple Olive... }	= { ...Yellow Orange. ...Red Orange. ...Pure Orange. ...Pure Orange. ...Russet Orange. ...Citrine Orange. }
-------------------	---	--

The law of repetition has been mentioned as one to be observed in designing. In art generally it is made to play a great part. Why the number three should stand so prominently to the front in this connection is a question worthy a disquisition by some master mind. In colors we have the three primary, the three secondary, and the three tertiary, and we have also three great relations of harmony and contrast among colors, as shown in the diagrams now introduced. In sculpture we find the three graces; in painting the three goddesses. The favorite division of a drama is into three acts; artists almost invariably group their figures in threes; and in design the attempt should be made by the student to conform as far as possible to this number in the repetition of figures and colors. In each of the three relations given above we have three colors—in the first, yellow, citrine, and purple; in the second, red, russet, and green; in the third, blue, olive, and orange. It will now, however, be better perhaps for the student to put in practice the rules and suggestions already given, as a lengthened exposition without the aid of colored designs for illustration of the text might become tedious and complex.—*Textile Manufacturer.*

DRY PLATES FOR TRANSPARENCIES.

WITH regard to exposure: much will, of course, depend upon circumstances; but it may be taken as a general rule that a full exposure, and slow, well restrained development will give the best results. As an example of what may be done in correcting abnormally long exposures by suitable development, we may note that the charming collodio-bromide slides exhibited by Mr. John Nesbit at the recent meeting of the Amateur Field Club, were many of them exposed in the camera the whole of a winter's day, when ten minutes or a quarter of an hour would have sufficed. The results were perfect, and though this is unnecessarily straining a point, it proves the flexibility of the manipulations.

With regard to the development: we should call the attention of those of our readers who are familiar only with the *gelatine* dry plates, that dry collodion plates differ very greatly in the mode of development they require. The chief point to be borne in mind is that they will not stand the application of nearly so large a quantity of ammonia. The quantity, or rather the strength of ammonia used to start a *gelatine* plate would hopelessly ruin most collodion ones. Another point in which the development differs is in the absence of the necessity for a dish in which to perform the operation, as well as of any tendency on the part of the film to stain or discolor from prolonged contact with the developing solution. Further than this, a much more comfortable light is allowable than with *gelatine* plates, and the progress of the development may be accurately estimated by examining the plate by transmitted light.

The solutions required are as follows:

A.	
Liquor ammonia, s.g. 0.880	1 drachm.
Bromide of potassium	20 grains.
Water	1 ounce.
B.	
Pyro	2 grains.
Water	1 ounce.

In addition to these a mixture of methylated alcohol and water, in the proportion of two to one, and a plain solution of ammonia 1:8, and bromide of potassium thirty grains to the ounce, should be kept.

Before commencing to develop, the plate is placed upon a pneumatic holder or leveling stand, and the dilute alcohol poured on in sufficient quantity to cover it. This flows as easily as collodion, and is returned to the bottle and employed over and over again, its only use being to prepare the film to receive the developer. Should the wash of alcohol be omitted the image will be, in all probability, extremely thin and poor, owing to the inability of the developing solution to penetrate the pores of the collodion film. The plate is next placed in water to soak, or rinsed under the tap until the water flows evenly from its surface, when it is ready for development. Pour into a developing glass a sufficient quantity of solution B to cover the plate comfortably, and having taken the latter on a pneumatic holder, flood it with the pyro solution. Now drop into the cup one minim of A for each drachm of solution, mix with the pyro, and return it to the plate, which should be kept gently in motion until the image commences to appear.

This will take probably a minute. The progress of the development must be carefully watched, and if all go well a beautifully-delicate picture will make its appearance, showing perfectly as a positive by reflected light, but possessing little or no density when examined by transparency. Watch for the finer details of the lights, and when these appear pour off the developer into the cup, add to it a similar quantity of A to that employed at first, and again return to the plate. This will immediately cause the image to gain density, and generally with such rapidity that it is necessary to watch very carefully for the proper moment to stop the action. If insufficient density be obtained in this manner a few drops more of the ammonia solution may be used; but great care should be observed to avoid fogging the plate or causing an appearance resembling solarization.

If from under exposure the first addition of ammonia fail in bringing out the details, a drop or two of plain ammonia solution will be required, while if the development proceed too rapidly more potassium bromide will be necessary. When the development is complete the plate presents a beautifully delicate appearance by reflected light—quite different from a *gelatine* plate. The shadows are of a pinkish purple-brown color, with a peculiar bloom resembling that of a bath plate under the most favorable conditions, while the lights, if pure, are represented by the opalescent bluish-white tint of the unreddened bromide. By transmitted light the effect is totally different, a clear vigorous image being shown.

It may happen that, from error in exposure or other cause, there may be a lack of intensity, in which case a touch of pyro and silver will improve matters. If there be a general lack of force, though the gradations of the image are correct, the intensification should be performed before fixing. If there be a flatness or want of contrast it will be better to fix first. Except in cases where it is intended to intensify subsequently the fixing agent should be weak pyro.

The intensification is performed with solution of pyro, one and a half grain to the ounce, to which a few drops of the following are added

Nitrate of silver	30 grains.
Citric acid	20 "
Nitric acid	10 minims.
Water	1 ounce.

Be careful not to use this too freely, or a coarse image and a bad color will be the result; but by proceeding slowly very rich brown tones may be secured, as well as the desired "sparkle" and pluck. One or two drops of the above to each drachm of pyro solution will suffice to commence with, and a little more can be added as the intensifier colors.

If sulphate of quinine be used in the emulsion the tone of the resulting transparencies—unless under exposed—will generally be satisfactory. Great variety of tone may be produced by varying the exposure, and also by adding to the alkaline developer small quantities of a saturated solution of acetate, phosphate, or tungstate of soda, or ferrocyanide of potassium. Ferrous oxalate gives black tones, but these are generally considered too cold for lantern work.—*British Journal of Photography.*

COATING PAPER WITH GELATINO-CHLORIDE OR BROMIDE.

BY T. G. WHAITE.

To successfully cover a large surface of paper with *gelatine* emulsion in a fluid state will be found by most operators a very difficult proceeding; the irregular expansion and cockling of the paper when the warm emulsion is applied, and the rapid setting in pools and waves, make it almost, if not quite impossible to obtain a sufficiently level and evenly coated surface for printing by contact, especially if the smallest piece of the margin should escape coating, which is very likely to be the case, working, as we do, in so dim a light, and with such an obstinate and ill-flowing a medium as *gelatine* emulsion.

After trying numerous methods with varying success, it occurred to me to try coating the paper with a cold and "set" emulsion; this I find to answer perfectly, leaving nothing to be desired, the apparatus required being exceedingly simple and inexpensive. It consists of a hot water reservoir, as per diagram, made of zinc. It is open at top of the two small projecting pieces, A A. The hot water is

poured in at these, and they act as cisterns to insure the complete filling of the reservoir, and moreover, serve as guides, keeping the paper between them in its passage over the heated surface. The back, ends, and base should be covered with felt. It will then be unnecessary to have any light burning under it, as the once filling with boiling water will be sufficient for three or four hundred feet of paper. At the back and top of this apparatus a leveled bench is placed, say twenty-four inches wide, and the desired length, a little less than half the length of the room, say eight or ten feet, and in front of the reservoir another bench the same length, the upper one for leveling and setting on, the lower one for coating, placed thus:

Suppose the paper used for carbon tissue be selected twenty-two inches wide and cut in eight or ten foot lengths—a convenient size to handle—place one of these on lower bench, and with a stiff hog hair brush about eight inches wide, something like a small whitewash brush, take the cold emulsion either in lumps or after being squeezed through Berlin canvas (I prefer it in lumps), and work it with the brush all over the paper, as a paper-hanger would his paste; it very quickly gives way to a vigorous attack with the

brush, and looks very smooth and free from lumps, even at this stage. Now take one end (having previously filled the cistern with boiling water), and steadily drag it from the lower bench to the upper one, between the two uprights A A of hot water cistern; the least contact with the zinc is sufficient to flow it, and it again sets almost as soon as it reaches the leveled bench; it may now be left there until another sheet is covered with the cold emulsion, and then hung up to dry in a cool draught. If it be thought desirable, a second coat can be applied, but this I have not found necessary.

Should a very thick and glossy surface be desired, it may be found necessary to reduce the proportions of *gelatine* to the chloride or bromide; a much larger proportion of the sensitive salt can then be applied to the paper.

One word of caution: do not let the sheet remain still for an instant in contact with the heated surface; a steady drag over is quite sufficient to break down the now well divided over jelly; the least hesitation or prolonged contact will denude it of some portion of the emulsion, and make wavy lines like those we find on ill-prepared albumen paper.—*Photographic News.*

NEW FORM OF ELECTRO MAGNET.

By PROF. FRED. ARZBERGER.

THE electro-magnet is now in so frequent use that a description of a new and simplified form of this apparatus is of a nature to prove interesting to the reader.

Such an arrangement is shown in the annexed figures, where M represents an elbowed piece of soft iron, to which is screwed a cylindrical core, E (also of soft iron), which carries a bobbin. The two brass plates, S S, screwed to the arm, M, carry the axis of oscillation, C, of the armature, A, which is connected by two screws to the lever, H.

Beneath this axis of oscillation, between A and M, there is a space of one to two millimeters to allow of the play of the armature, A, on its axis. Owing to the little distance which separates these parts, this electro-magnet acts like a horse-shoe magnet, although it is provided with but a single core and a single bobbin. Electro-magnets of this kind act with more force and possess the advantages of simplicity and cheapness.

Fig. 1.

Fig. 2.

Attention is now called to a subject the practical importance of which will be at once evident.

The corrosion of contact points produces in many apparatus frequent troubles, especially when the contact cannot act very strongly.

I have had for the last twelve years an electric pendulum, working without interruption, to which there is adapted an instrument that I have called a discharging resistance coil. This apparatus is constructed as follows:

I take a piece of fine brass wire, covered with silk, and having six to eight times the induction resistance of the magnetizing bobbin, and first stretch it and then bend it in the middle in such a way as to form a double wire, in which, when a current passes, there develop two parallel currents of equal force, which are in immediate proximity and which meet one another. If this double wire be wound on a bobbin, an induction of the spirals cannot of itself be accompanied by any immediate result. This bobbin, then, produces no spark at the time of closing or interruption. As may be seen in Fig. 2, the magnetizing bobbin, M, and the discharging resistance bobbin, W, are connected with two clamps, K K, in such a way that the extra current discharges itself through W, thus preventing the production of a spark on contact. If, for example, W has six times the resistance of M, one-seventh of the total current will pass through W, and six-sevenths through M. There is, then, for the current a loss of one-seventh, which may be sacrificed in the majority of cases, when, by any means so simple, inexpensive, and occupying so little space, sparks occurring at the breaking of the current may be avoided.

ARRANGEMENTS FOR LIGHTING RESIDENCES OF W. H. VANDERBILT, ESQ.

THE magnificence of these dwellings has attracted so great attention, not only in this city but throughout the country, that we feel sure our readers will be especially interested in a description of the arrangements for lighting, water supply, drainage, heating, and ventilation.

A brief preliminary description of their situation, external appearance, etc., is prefixed for those of our readers who have not seen them.

They are situated on the west side of Fifth avenue, nearly opposite St. Patrick's Cathedral, about a third of a mile below Central Park, and occupy the whole length of the block between Fifty-first and Fifty-second streets. They are of brown stone, elaborately carved, three stories in height, beside a fourth lighted from a roof, and a basement (with no cellar). In external appearance the two houses are almost identical, but that on the corner of Fifty-first street is called the single house in distinction from that on the corner of Fifty-second street, called the double, which is designed for two families. The two parts of the latter house have no rooms in common (though they may be connected), and separate systems of drainage, water, and gas supply, so that so far as plumbing is concerned, there are really three houses. The single house is occupied by Mr. Vanderbilt himself, and the double by his sons-in-law, Messrs W. D. Sloane and Elliot F. Shepard.

The main entrances to Mr. Vanderbilt's and Mr. Sloane's residences are on Fifty avenue, through a grand porch about thirty feet long, connecting the two houses, while that to Mr. Shepard's is on Fifty-second street.

We begin with the lighting apparatus in Mr. Vanderbilt's residence, which, as will appear, is very elaborate and extensive.

The gas fitting was done by Messrs. Robert Ennever &