

sulphide of iron; B contains the dilute acid. To start the reaction, open stop cock D and blow gently through H. The acid siphons over through F until its end is exposed. It is necessary to have this tube short, that the siphon may empty and cause a slight back pressure. When considerable pressure is required a stopper must be placed on H. When the stop cock is closed, the liquid returns to B and action ceases.

It will be noticed that the upper and better part of the acid is always used.

While gas is being delivered, B can be disconnected at F and the spent acid thrown away.

A generator of this form can be made for 25 cents. The bottles can be put in a block for convenience in handling.

A DISCUSSION OF NEWTON'S THIRD LAW OF MOTION.

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The thoughtful pupil, who is studying the laws of motion for the first time, is sure to find difficulty in reconciling Newton's third law with the principle of balanced forces. The meaning of this law is that every force is accompanied by an equal force in the opposite direction. Before reaching this point, the pupil has been taught that, if two equal forces act in opposite directions upon the same mass, no motion results. If these two statements are the whole truth, motion is an impossibility.

A simple illustration makes the matter clear. I have used the following in my class room and I have good reason to believe that the result has been a clear conception by a majority of my pupils of the meanings of these two laws and the relations existing between them: I hold in my hand a spring balance from which is suspended a mass of, say, five pounds. The force due to gravitation is five pounds and is acting upon the mass in a downward direction. The hand is exerting an equal force in an upward direction and there is no motion. These points and

those that follow are, of course, brought out by questioning. To move the mass upward, the upward acting force must be increased. I do this and, for an instant, the index of the balance indicates eight pounds. The total force exerted by the hand upon the mass at the instant of setting it in motion is eight pounds. That the mass is affected by an equal force in a downward direction, we know, since it stretched the spring as much as an eight-pound weight would do. The added downward force of three pounds is due to the inertia of the mass (and this makes the meaning of inertia more clear). We have, then, two equal forces acting in opposite directions upon the same mass and the mass is set in motion. This is true because one of those equal forces consists in part of the force due to inertia. We must, therefore, recognize a force of inertia and we may include Newton's third law and the principle of balanced forces in one comprehensive statement thus: Every force is accompanied by an equal opposing force. The effect of such equal opposing forces is rest, except one of the forces consist in whole or in part of the force of inertia, in which case the effect is motion.

EXPERIMENTS WITH THE SCHOOL ELECTRICAL MACHINE.

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For two years past, whenever time has permitted, I have been conducting a series of experiments which are of the greatest interest to me, and which I believe will prove of equal interest to most science teachers. As the necessary apparatus ought to be, and probably is, to be found in every high school, I call the attention of high school teachers to them. The experiments are a study of the forms of high potential electricity as recorded by its direct action on the photographic plate.

The first success in producing a visible record of electrical forms seems to have been achieved by Lichtenberg, in the last quarter of the eighteenth century, by dusting sulphur, red lead,