

# SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LIII.—No. 12.  
[NEW SERIES.]

NEW YORK, SEPTEMBER 19, 1885.

[\$3.20 per Annum.  
[POSTAGE PREPAID.]

## Spontaneous Combustion.

Mr. C. C. Hine, editor of the *Monitor*, relates the following: "The Institute of Technology, at Boston, long ago decided upon the danger of steam pipes passing through and in contact with wood. It was shown that the wood, by being constantly heated, assumes the condition, to a greater or less degree, of fine charcoal, a condition highly favorable to spontaneous combustion. Steam was generated in an ordinary boiler, and was conveyed therefrom in pipes which passed through a furnace, and thence into retorts for the purpose of distilling petroleum. Here the pipes formed extensive coils, and then passed out, terminating at a valve outside the building. To prevent the steam when blown off from disintegrating the mortar in an opposite wall, some boards were set up to receive the force of the discharge, and as often as the superheated steam was blown, the boards were set on fire."

## THE GREAT TANGENT GALVANOMETER OF THE CORNELL UNIVERSITY.

The cut represents a standard galvanometer constructed at the Cornell University from designs of W. A. Anthony, Ph.B., Professor of Physics, to meet the want of a standard instrument for the measurement of heavy currents, and for the direct calibration of the commercial instruments in use for measuring the currents employed in electric lighting, etc.

For the measurement of heavy currents there are four circles, two 2 meters in diameter and two 1.6 meters diameter, mounted according to Helmholtz's plan at distances apart equal to their radii. The conductors forming these circles are copper rods, three-fourths inch in diameter. The needle is suspended by a silk fiber in a mass of copper, which serves as a very effectual damper, and makes it possible to take readings very rapidly. By a peculiar arrangement of mirrors

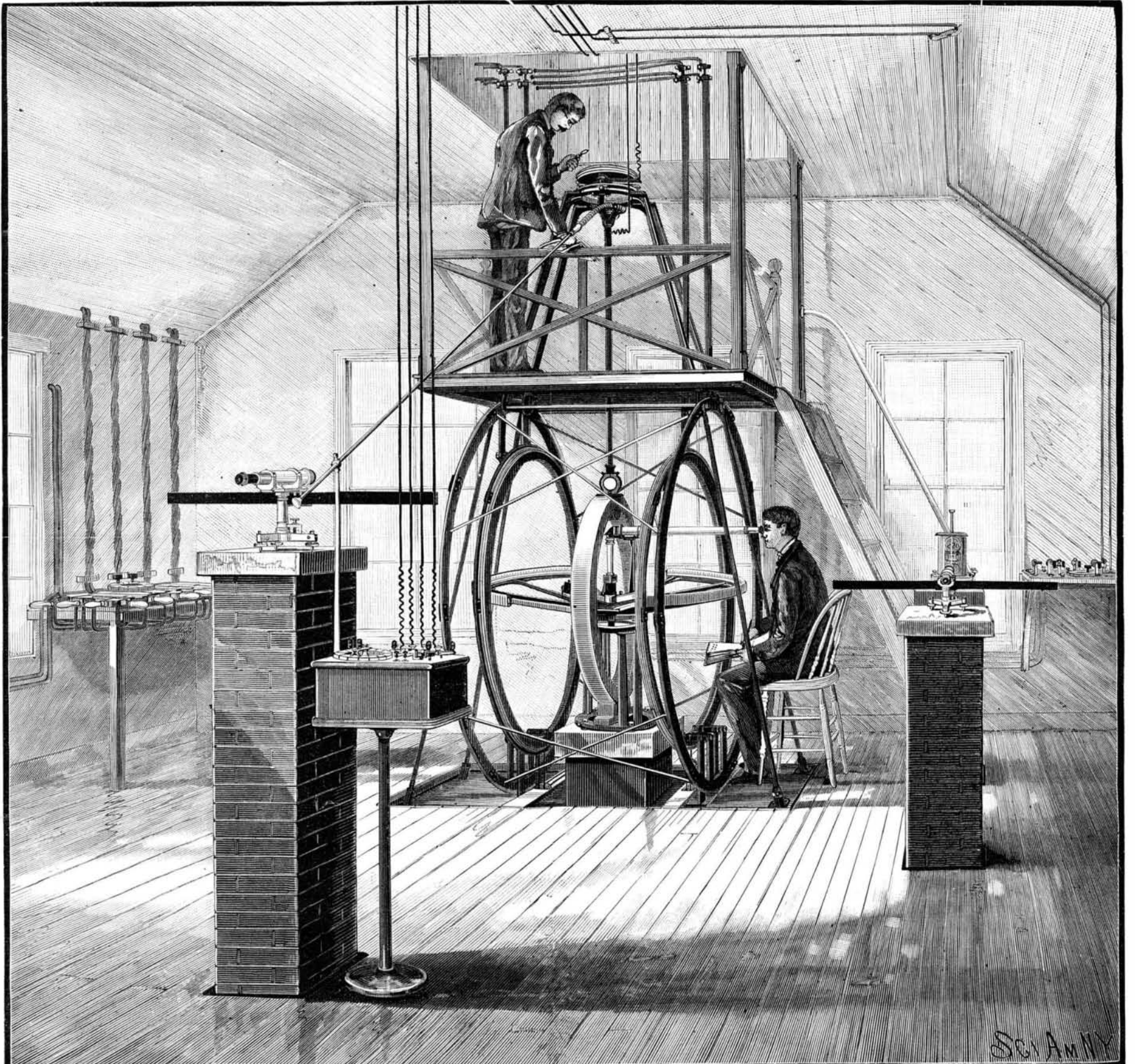
and telescope the deflections are read directly in angular measure on a circle 50 inches in diameter to within three-tenths of a minute of arc. The copper conductors are mounted on a brass framework accurately turned and adjusted, and the dimensions are all known within one five-thousandth.

For the measurement of small currents there are two circles, about 1.5 meters diameter, each having two conductors, and comprising altogether 72 turns of No. 12 copper wire.

The indications of such an instrument, of course, depend upon the value of the horizontal intensity of the earth's magnetism, and without some means of determining this quantity in the place where the instrument stands, and at the time when a measurement is being made, no great accuracy is attainable.

For making this determination a coil, 1 meter in di-

(Continued on page 182.)



THE GREAT TANGENT GALVANOMETER OF THE CORNELL UNIVERSITY.



### THE GREAT TANGENT GALVANOMETER OF THE CORNELL UNIVERSITY.

(Continued from first page.)

ameter, consisting of 100 turns of No. 18 wire, is suspended, so that its center coincides with the center of the instrument, by means of a single phosphor-bronze wire, which is itself attached to a torsion head reading to 10 seconds of arc. By the aid of this coil, observations may be taken at any moment for the determination of H by the method proposed by Sir Wm. Thomson.

The instrument is mounted in a copper building (shown in the small engraving), from the construction of which all iron has been rigidly excluded. Several conducting wires connect the building with the dynamo and other rooms of the physical laboratory, 550 feet distant, and switches in the building serve to send the currents through the several coils of the galvanometer singly, in series, or in multiple arc, direct or reversed. By this means currents from 1 milliamperes to 250 amperes can be accurately measured.

#### Revival of an Old Armor Belt.

Mr. McIntyre, late superintendent of construction of the English warships *Swiftsure*, *Triumph*, and *Terror*, has patented a new type of armor plate. The design includes the complete protection, at the water line, of warships by a >-shaped armor belt.

The two plates forming the belt would have a horizontal projection of 5 feet and a vertical height of 10 feet, or each plate would be on an angle of 45°. The upper plate, in a design submitted, would be 8 inches thick by 7 feet wide, the lower plate 5 inches thick by 7 feet wide, and below all is a vertical plate 9 inches thick by 2 feet wide. The apex of the ">" would be at the water line.

Mr. McIntyre calculates that the resisting power to shot is doubled by the inclination of the plates, and that the saving in weight over vertical plate of equal resistance is as 7 pounds to 10 pounds. Among the other advantages it makes ramming by an enemy's ship dangerous work to the attacking party, the overhang forms a good point of attachment for torpedo netting, and, by adding to the ship's beam at the water line, it will materially steady the vessel in rough weather. *Engineering News* says the expedient is simple and seems effective, but the idea is practically antedated by the rams *Vindicator* and *Avenger*, built about 1864 for service in the Mississippi Squadron during our own late war, where the ">," however, was solidly packed with wood.

#### Salicylic Lemonade.

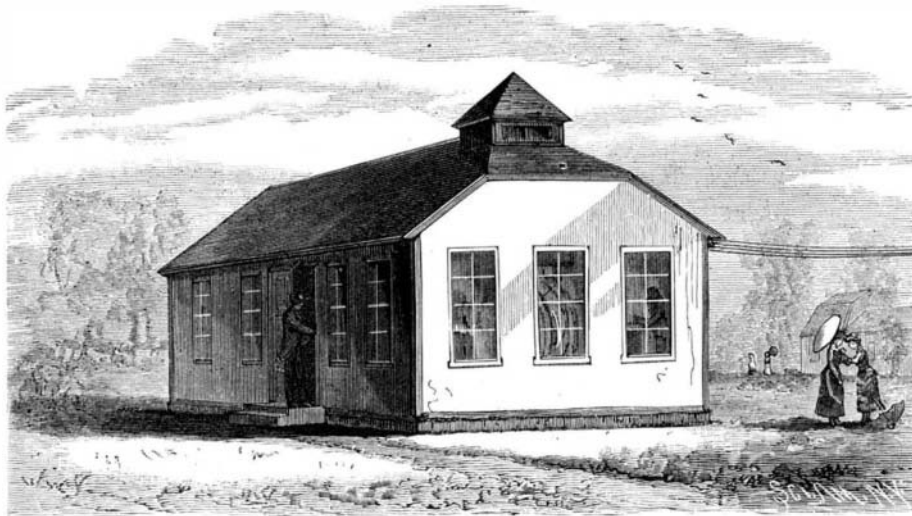
As a "hospital beverage," says the *British and Colonial Druggist*, which has lately been found of great value in typhoid and other fevers, scurvy, and gout, the following cannot be too widely known, it having been, we understand, first devised by a late medical officer attached to the Sudan expedition: Fruct. limoni, No. 10; acid citric, ½ oz.; acid salicylic, 200 grains; sacch. alb. and water, q. s. Squeeze the lemons, and put the juice aside; boil the fruit in half or three-quarters of a gallon of water for fifteen or twenty minutes; after standing for six hours take out the lemons, and again press them before throwing the exhausted pieces away. Add the juice and citric acid to the

quired to be in a "bright" condition, add, when cold, a little beaten up with white of egg. Boil for three minutes, and filter. If found too harsh for some tastes, dissolve in the boiling liquid, before straining, half an ounce of Nelson's patent opaque gelatine, previously swelled for five hours in cold water.

#### A Western Cannon.

On memorial day in Griggsville, Ill., a cannon was used which was presented to the late Col. R. B. Hatch by the 7th Iowa Regiment in 1861, at Cairo.

This cannon was manufactured in a machine shop in Iowa or Missouri by an ingenious mechanic.



GALVANOMETER BUILDING.—CORNELL UNIVERSITY.

The barrel is steel, 3 feet in length with 1¾ inch caliber, rifled, and is capable of sending a projectile five miles with the proper elevation.

It is exploded by percussion cap with back action lock and hammer, like an ordinary fowling piece.

The breech pin can be detached at each charge, and cooled in water, which in a certain degree would prevent premature explosion. H.

#### IMPROVED BLOOMING MILL

The blooming mill which we illustrate was constructed by the Tees Side Iron and Engine Works Company of Middlesbrough, for the Sociedad de Altos Hornos y Fabricas de Hierro y Acero de Bilbao. The rolls, which are not shown in the engraving, are 39 in. in diameter, and each of them weighs 14 to 15 tons; the standards weigh 20 tons each. The mill is driven by a pair of reversing engines connected in the ordinary way by means of wabblers and boxes to cast-steel pinions 39 in. in diameter, with helical teeth 2 ft. 5 in. wide. The roll-adjusting gear is placed on a strong cast-iron girder spanning the roll standards, and consists of a hydraulic cylinder with the piston rod projecting through each end, and attached by means of links to cast-steel spur quadrants, working into steel pinions keyed on to steel screws 10 in. in

The live rollers, which are of wrought-iron with cast-steel centers and steel shafts, are driven by means of cast-steel spur and miter gear, the motive power being supplied by a pair of reversing engines with cylinders 8 in. in diameter and 15 in. stroke. The whole of these rollers are carried upon heavy cast-iron girders with brass bearings.

These rolls form part of an exceedingly fine blast furnace and steel rolling mill plant with all the most modern appliances and improvements, including blooming, roughing, and finishing mills, reversing engines for rollers, the latter being of wrought iron with steel centers, steel shafts, and steel miter wheels. The plant also embraces a fine powerful shearing machine which weighs 85 ton, a hydraulic crane for lifting the cross ends from the shears, a hydraulic push-over gear for moving the blooms from the roughing to the finishing mill, a powerful sawing machine for cutting the steel hot with a neat arrangement of stop gear, and rail bench, nearly 100 ft. long, with an apparatus for moving the rails.

*Engineering* says: "The whole of the details have been carefully worked out, and reflect great credit on the engineers."

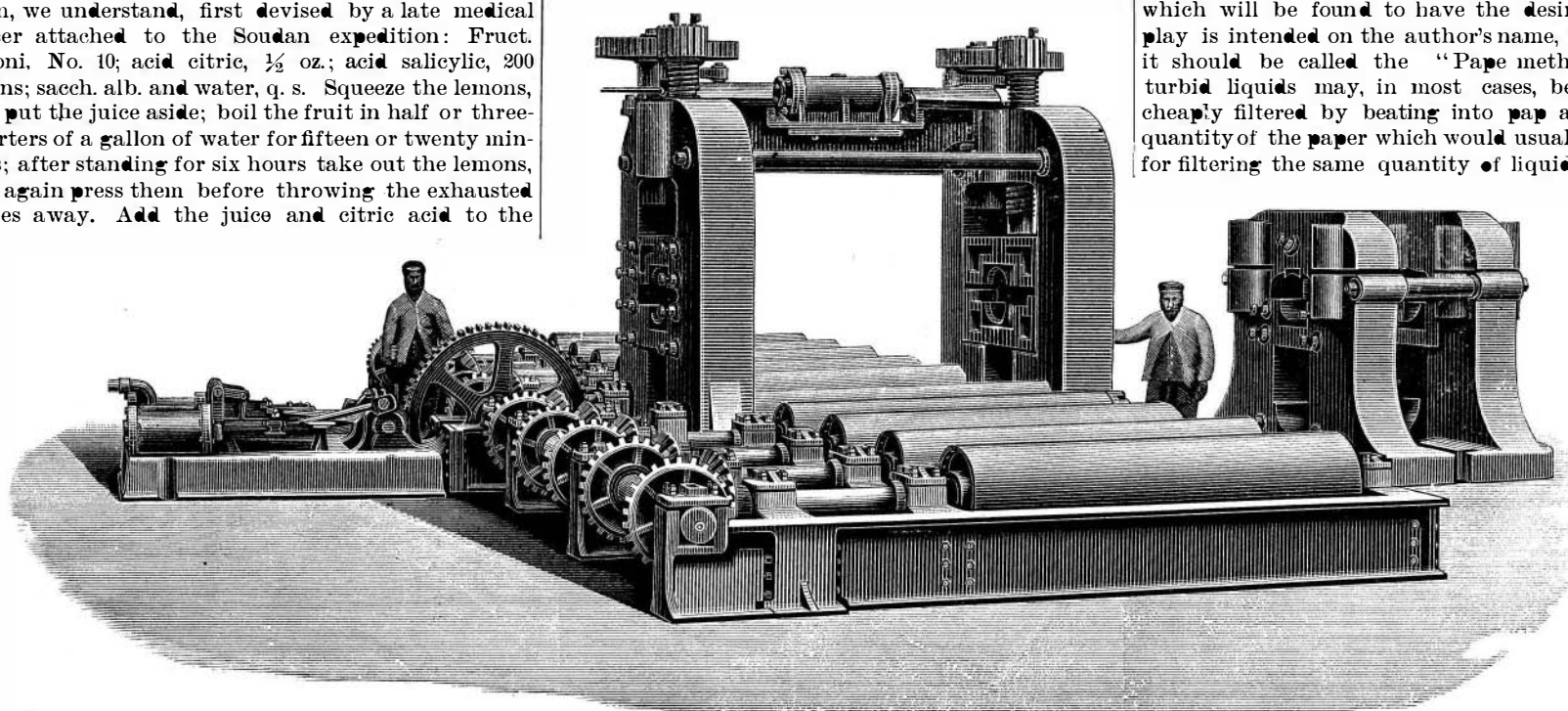
#### The Boys in the Pennsylvania Coal Mines.

By a recent enactment of the Pennsylvania Legislature, boys under fourteen years of age, and all women and girls, are prohibited from being employed in the coal mines of that State, and most of the large coal

mining companies have been discharging such help during the past three months. It is estimated that the law covers nearly one-half of the whole number of slate pickers in the mines, at which boys are sometimes employed when only six years of age, while it also includes a good proportion of the mule drivers and door tenders. The slate pickers sit in rows astride the chutes leading from the breakers, their eyes fixed on the broken coal steadily brushing by them down an incline, and acquire great expertness in picking out the dull slate from the glistening anthracite. The work is hard, in the stooping position and dust, and really seems but little removed from a hard form of slavery, yet these little workers form so important a factor in the means of support of many families, that it has required many years' agitation to get the law for their amelioration passed through the Legislature, and its enforcement now is causing no little excitement in the mining regions. Yet society undoubtedly owes it to itself to see that these little ones are at school, instead of being thus early predestined to a life of ignorance.

#### New Method of Filtering.

The filtration of turbid liquids sometimes presents great difficulties and no little annoyance. These liquids, which are difficult of clear filtration, may, according to Mr. Pape, be treated by a novel method, which will be found to have the desired effect. No play is intended on the author's name, but he tells us it should be called the "Pape method." In fact, turbid liquids may, in most cases, be readily and cheaply filtered by beating into pap about half the quantity of the paper which would usually be required for filtering the same quantity of liquid, and running



BLOOMING MILL FOR BILBAO.

liquid, boil five minutes, and strain. While hot add the salicylic acid, and stir until dissolved. Sweeten to taste with white sugar, and make up the bulk to one gallon with water.

Salicylic lemonade may be taken freely, either of the strength here given, or diluted with half its bulk of water. It should be freshly made every two or three days, unless it be permissible to "qualify" it by the addition of a little pure French brandy. If re-

diameter; these, again, work into heavy cast-iron nuts fixed into the top of the standards.

The top roll is furnished with balance gear to keep the roll at all times in contact with the upper bearance. This balancing gear is placed underneath the mill, and consists of two heavy rods passing through each standard, which connect to the bottom bearance of the top roll, and are actuated by means of levers and balance weights.

this pap into the filtering funnels, the stems of which have been previously fitted with small plugs of cotton-wool, care being taken that the latter is quite free from fatty matters; such is the medicated cotton-wool supplied for surgical purposes. The funnel is therefore closed at its lower end with this pure cotton-wool, over this is placed the more or less fluid or pasty paper pulp, and over this again the ordinary conical filter paper.