I cause the annular cupping apparatus to adhere by a pressure on its bulb.

Then, turning to the patient, I find that her veins are so bloodless as to be invisible. I succeed in discovering them by placing a bandage on her arm. I raise a fold of the skin transverse to the median vein, and, cutting it with the bistoury, find that the vein is bluish and very narrow. I prick it with a fine erine, and then, removing the bandage from the arm, confide to Dr. Brochin the care of cutting a small piece from the vein with the point of a fine scissors and of introducing the canula into the narrow vessel. A few drops of very pale, thin, and incoagulable blood run out.

During this time I have dipped the bell of the aspirating tube of the instrument into a vessel of water heated to about 40 degrees. By working the bulb, this water fills the entire transfuser, heats it and expels the air that it contains. It was after all the air was expelled by the water that Dr. Brochin introduced the canula into the patient's vein.

The patient is now in such a state of inertia and anemic anæsthesia that she makes not even the slightest movement, either during the incision of the skin or during the preparation of the vein.

Our two subjects are now united by an uninterrupted channel full of water and free of air. A sharp tap on the head of the lancet opens Renaud's vein, and his blood soon makes its appearance at the orifice of the tubes, after having driven the water before it. The water section tube as well as the expulsion tube are closed, and a direct current of blood is set up. Slowly, never removing my eyes from the patient, I press the pump bulb, and force the blood easily into the vein in quantities of 10 grammes each time. At the tenth contraction of the bulb the patient breathes more deeply and quickly. When questioned she answers that she feels no discomfort, but experiences a heat rising from her arm into her breast.

Dr. Brochin easily ascertains under his finger that the blood is distending the rubber tube and the vein at each pressure; and, moreover, we all perceive the vein becoming more apparent and turgid as far as the arm pit.

At the seventeenth injection of ten grammes, perceiving a resistance in the bulb and a slight agitation in the patient, I stop transfusing, after 170 grammes of Renaud's blood have passed into the patient's veins.

The preparations for the operation were somewhat prolonged by the absolute lack of comfort and room in the apartment. It was difficult to light the latter well, and Dr. Chauvin was good enough to hold a lamp so as to light alternately each subject. The operation itself lasted five minutes.

Renaud's arm was dressed with a simple bandage, and he returned to his work very much pleased with the service that he had rendered.

February 8th.—The patient has slept, although she has awakened several times. During the day she has eaten six times. She has spoken aloud, and has not felt the least pain.

February 9th.—The patient has slept well the entire night, and for the first time in six months.

Feb. 10th and 11th.—State of convalescence assured.

February 12th and 13th.—Madame M. is sitting up, and is certainly cured. Hereafter she can dispense with my care.

Such is the interesting case that we have desired to make known. It now remains to say a few words in regard to the instrument employed by Dr. Roussel—his transfuser.

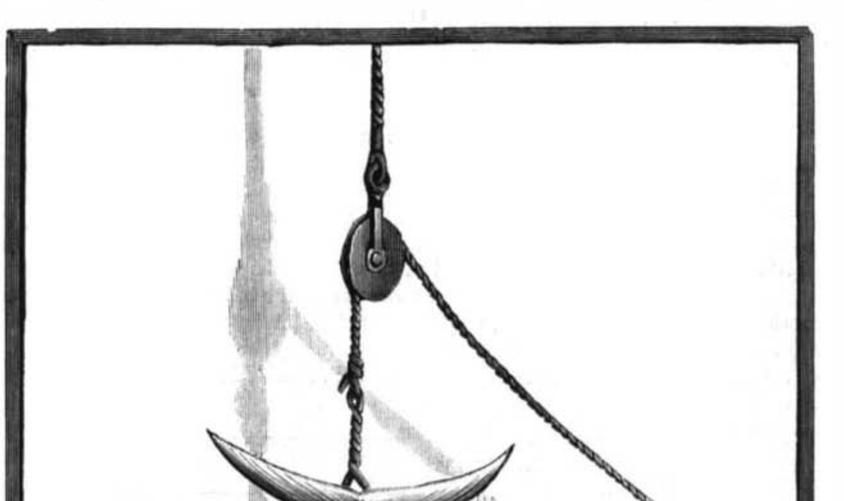
The apparatus consists of a soft, elastic, warm, and moist tube, after the style of the blood vessels, designed to be placed between the vein that yields the blood and that which receives it. This tube carries a suction and force pump, which gives impulsion to the venous blood, while measuring the quantity and velocity of the same. Two bifurcations, one at the beginning, and the other at the end of the tube, allow of the entrance and exit of a current of warm water so as to drive out the internal air and heat the instrument without the water itself being forced into the patient's circulation.—*La Nature.*

THE nitric solution of the two metals is mixed in a beaker, or a large porcelain crucible, with 4 to 5 c. c. of pure glycerine, supersaturated with ammonia, and mixed with 10 to 15 c. c. of concentrated soda-lye. The clear liquid thus obtained is heated, and boiled for three to five minutes; the formation of a silver deposit on the sides is prevented by stirring with a glass rod. When cold the reduced silver is filtered off, washed with boiling water, with warm dilute acetic acid, and again with hot water. The acetic acid in the filtrate is neutralized, and the lead thrown down with sulphureted hydrogen. The separation of silver from lead is practicable in presence of copper and bismuth, as the oxides of these metals are soluble in glyceric alkalies.—*E Donath.*

THE AMERICAN TUNNY.

BY C. F. HOLDER.

Probably no family of fishes exceeds the mackerels (*Scombrinæ*) in their economic value. Having a wide geographical range, the different genera are found in almost all the waters of the world, everywhere being a benefit to man, and from their beauty, form, and peculiar habits attracting universal attention. The family is divided into four sub-families: 1st. Scombrinæ, distinguished by the short first dorsal and the wide space between it and the second, and the pectorals high up, including the genus *Scomber*, or common mackerels. 2d. The Orcyninæ, of which the subject of our illustration is a member. Here the spinous dorsal is contiguous to the soft, the pectorals comparatively low, the caudal peduncle with a median adipose carina, or fleshy keel, and two others, one above and one below, converging backward. This sub-family includes orcynus, sarda, and cybium, and related forms. 3d. Thyrsitinæ, in which the spinous dorsal is also long and pectorals comparatively low, but the caudal peduncle is not keeled. This family includes the genera thyrsites, ruvettus, etc. 4th. Gempylinæ, distinguished from the others by the very long body (the height being less than a tenth of the length), and the numerous spines of the first dorsal, represented by the genus gempylus. Very recently an American tunny was brought into Fulton Market, and from its great size attracted general attention. It was nearly nine feet long, and weighed between 800 and 900 pounds—a magnificent fish, its entire make up denoting wonderful speed and activity in its native element, where, with their rich coloring, iridescent and silvery tints, they present a wondrous spectacle. It is rarely that they are captured so near New York city. In Rhode Island and by some of the more northern fishermen it is called the albicore, as well as American tunny, and its range is from Newfoundland to Florida. Rondelet figures a tunny under the name Thon, and another species which he calls Pelamyde, or Thon d'Aristole. The first he denominates in Greek as Orkunos, which, he says, is the "Grand Thon." The generic name now used is evidently from the old Greek designation, and tunny is from thynnos, the more common term in use among the ancients. The fish seems to have been well known along the Mediterranean Sea. Rondelet figures a bize, which he calls also sarda, and which he says is called by Pliny pelamydes. It will be seen, then, that these names, which are retained by modern naturalists, were used by the earliest writers to designate species very closely allied.



THE AMERICAN TUNNY.

Storer says: "The species known along our coast as horse mackerel and albicore comes on to Massachusetts Bay about the middle of June and remains until October It is frequently taken for its oil, which is taken from the head and belly, a single specimen often yielding twenty gallons."

They grow to a great size, and in 1855 one was caught off Lynn, Mass., that weighed over 1,000 pounds, was 10 feet long, and 6 feet in girth. It was presented to the Lynn Natural History Society by Dr. J. B. Holder, who was then the honorary curator. In a memorandum note in the History of Lynn, Dr. Holder says: "In this year (1850) they were very abundant, small ones being seen jumping out of the water; and I have measured several that were 10 feet in length."

After this they were rarely seen, but in 1871 a number were observed, as well as great quantities of a small tunny, *Orcynus alliteratus*, which, remarkable to relate, and showing their great range, had previously only been known in the Mediterranean Sea. The common tunny of the locality is the *Thynnus vulgaris*, and is said to have been seen in our waters. It attains a much greater size than its American representative (*Orcynus secundo-dorsalis*). Specimens have been found 20 feet in length, exceeding half a ton in weight. A casual observer would hardly note a specific difference between the two, so much do they resemble one another. From a very remote period the fisheries near the Island of Sicily have been valued, and in the summer vast shoals of them are caught in large nets or by means of what the Italians call tonaro.

In appearance the thynnus bears a close resemblance to our mackerel, except in point of size. Each jaw is furnished with a row of small sharp pointed teeth, slightly curved inward; the tongue and inside of the mouth are very dark colored; the cheeks covered with long narrow pointed scales; the operculum is smooth; the dorsal and anal fins are followed by nine small finlets, and the tail is crescent-shaped. The upper part of the body is very dark blue; the belly a light gray, spotted with silvery white; the first dorsal fin, pectorals, and ventrals black; the second dorsal and anal nearly flesh colored, with a silvery tint; the finlets, above and below, yellowish, tipped with black. This description well applies to the American tunny, though the Fulton Market specimen had lost its brilliant colors when we saw it. Mr. Garrell, quoting from Mr. Couch, says that "the tunny appears on the Cornish coast of England in summer and autumn, but is not often taken because it does not take bait, or at least the fishermen use no bait that is acceptable to it, and its size and strength seldom suffer it to become entangled in the nets. It feeds on pilchards, herrings, and perhaps most other small fishes, but the skipper (*Esox saurus*) seems to be its favorite food, and it has been seen to leap in the air after them and endeavor to cut them down after the manner of the thrasher.

According to a French writer the greatest tunny fishery of the present day is that at Provence. Here the haul is made by an inclosed net called the *madrague*. The net consists of a combination of nets, which is quickly cast into the sea to head the tunnies at the moment of their passage. When the sentinels posted for the purpose have signaled the approach of a shoal of tunnies and its direction by the indications of a flag which points to the spot occupied by the finny tribe, the fishing boats are immediately directed to the spot indicated and ranged in curved lines, forming, with the light floating net, a half circular inclosure turned toward the shore, the interior of which is called the garden. The tunnies thus inclosed in this garden between the shore and the net become crazed with terror; as they advance along the shore they press upon the inclosure, or rather a *new* interior inclosure is formed with other nets held in reserve. In this second inclosure an opening is left through which the fish have to pass. In continuing thus to diminish the space by successive inclosures each occupies a smaller diameter, in which the fish are inclosed in about a fathom and a half of water. At this moment a seine is thrown into the garden, this is in turn hauled by the men into shallow water, and the small fish taken by hand, and the larger by hooks made for the purpose and thrust into the gills. A single day of such fishing will oftentimes produce 16,000 tunnies, ranging from twenty-five pounds upward. The madrague above mentioned is a permanent fishery, and consists of a vast inclosure formed of nets into various chambers, supported by corks and held in place by weights. The net is intended to arrest the shoals of tunnies as they leave shallow water for open sea. For this purpose a long alley or run is established between the sea shore and the park or madrague. The fish follow the run, and after passing from chamber to chamber, at last find their way into the interior. To force them near the "park" long nets are used, hauled by boats, and finally, when they are thoroughly in the toils, the net is raised to the surface, and the victims killed with poles and various weapons, the sport, if it can be called such, lasting the entire night.

As an eating fish it is there preferred to the salmon, and a French gourmand says of it: "For our part we put it far above salmon. Nothing is comparable to the fresh tunny thrown into a hot frying pan, and sprinkled with vinegar and salt. When properly cooked nothing can be more firm or savory. In short, nothing of the kind can rival or even be compared with the tunny as we find it at Marseilles and Cette."

The large tunnies of our coast are by no means such delicacies, though their cousins, the mackerels, when fresh and broiled—not fried—are equally up to the French ideal.

The Viscosity of Liquids, and its Relation to Chemical Constitution.

The time that it takes a liquid to flow through a capillary tube, under certain conditions, will depend on its viscosity. By comparing different liquids under exactly the same experimental conditions, the difference in tenacity, or their *specific viscosity*, can be determined from this difference in time. Richard Pribram and Al. Handl have been able to prove experimentally that there is an undeniable relation existing between the specific viscosity of homologous liquid substances and their chemical constitution, and that these can be expressed by definite rules for certain substitutions. By means of new and very carefully prepared pure substances, they have recently increased the number and value of their experiments. These have been published in two very exhaustive memoirs presented to the Vienna Academy of Science, and with them the conclusions drawn from all their observations. Omitting the special description of the apparatus employed, and the details of the separate experiments given in the original, the *Naturforscher* gives the following summary of their work.

The first question to be answered by farther experimenting was in regard to the action of isomeric esters (or compound ethers), of which Gueront had asserted that they possessed equal fluidity for equal volumes, the statement being based upon a few observations. It was not found to be strictly correct. It is true that the tenacity (or viscosity) for equal volumes of isomeric esters did not vary a great deal; but these variations ought not to be neglected, and it was found that there was a regularity within these variations which was clearly apparent if the esters were grouped together according to their composition.

If those esters were grouped together, in which the isomerism is due to simple interchange of alcohol radical for an acid radical, the table showed that in those cases where a difference could be seen with certainty, an ester containing a higher alcohol radical would possess greater viscosity, while the one containing a higher acid radical would, of course, have less tenacity, or greater fluidity. In general, these differences of specific viscosity for equal volumes increase as the molecular weight of the alcohol radical increases.

Interesting relations were further apparent in comparing isomeric ethers, in which the isomerism is due to a different arrangement of atoms in the alcohol radical or the acid radical. The compounds of this series which were examined showed that esters containing normally constituted radicals, were more viscous than those isomeric with them, and this was equally the case whether the isomerism was in the alcohol or in the acid radical.

Experiments were then made to ascertain whether similar relations to those last mentioned also existed in the other series. Among the haloid compounds of alcohol radicals, the butylic compounds acted the same in this respect as the esters. With propylic compounds, however, the difference in tenacity for equal *volumes* was very small, while for equal *quantities* the differences were larger; but in an opposite direction, the normal compounds having the smaller viscocity.

The aldehydes, like the ethers, showed greater fluidity in the normal compounds. The isomeric alcohols showed no regularity in the few examples examined, which belong here. A few nitro-derivatives of the fatty series, that can be introduced here, exhibited as little regularity.

"Now, if we take a general survey of the relation of normally constituted substances to the isomeric ones in the different groups, it will be seen that in the majority of cases the normal compounds have the greater viscocity. This rule applies to all the esters, the aldehydes, propylic alcohol (at 50° C.), nitropropane, butyric acid, and butylic iodide; on the contrary, the propylic haloids, butylic alcohol, and nitrobutane, all deviate from the rule."

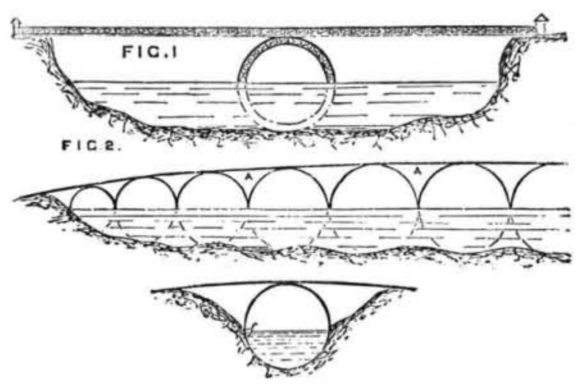
The relation which Brühl has very recently described as existing between the specific refractory power, and the presence or absence of numerous conditions of the atom in the molecule, gave them occasion for observing the specific viscocity in this direction. It was found that when an alcohol passed into an aldehyde or ketone, the fluidity increased. This is considerably greater when two hydrogen atoms go out, and there is a double bond formed between a carbon and an oxygen, than in those cases where the loss of hydrogen is compensated for by a double bond between two atoms of the same kind. This decrease of viscocity, when an alcohol goes into an aldehyde or ketone, is always the same per cent of the whole, whether calculated to volume or to quantity (weight). With increasing molecular weights, however, the absolute difference between homologous alcohols and their corresponding aldehydes or ketones is always greater.

The observations that have been made by this grouping may be embodied in the following general statement: "In homologous series, the increase of viscocity is in general proportional to the increase of molecular weight. The coefficient of increase, however, depends upon the structure of the molecule, and is constant only in those cases where the members of the homologous series, considered as binary compounds, contain one member that is fixed, and the other variable. In the series of halogen derivatives of normally constituted hydrocarbons, the form of the molecule has less influence than the weight of the molecule; with so-called isomeric compounds it is distinctly noticeable."

What was previously ascertained concerning acids was merely confirmed. An exhaustive discussion of the observations made on alcohols, and a comparison with the older results of Rellstab, lead to a surprising result, namely, that the two curves (of tenacity and molecular weight) run parallel only when the two butylic alcohols change places, the isobutylic alcohol being put in the normal series, and the normal alcohol transferred to the isomeric series of alcohols. Finally, the nitro-compounds confirm the law that the viscocity increases nearly in proportion to the increase of molecular weight.

NEW FORM OF BRIDGE SUPPORTS.

The accompanying diagram illustrates designs by Mr. J. F. Smith, Leicester, England. He proposes, says the *Engineer*, that bridges shall consist of iron or steel cylinders of any reasonable diameter, made up with plates riveted to rolled iron or steel ribs, the strength necessary to carry any weight required; they are generally of a circular section, and the lower half of the cylinder, or inverted portion of the arch, supports the upper half, and has a continuous bearing on the ground or bed of the river its whole length; the larger the cylinders the more stable the bridge. These bridges, or cylinders, may be riveted up in dry dock, a portion of the ends covered with movable plates, floated into position and sunk; the only trouble in foundations being in



cases where the bed of the river is rocky and uneven, then it is necessary to level or groove the bottom with "jumpers" from a platform over the line of intended cylinder. For small water-courses under turnpike and other roads, Mr. Smith says these bridges may be riveted up on the spot, rolled in, covered over, and the bridge is made as in Fig. 3, without any piling, diverting watercourse, building foundations and arches, or other trouble and expense usual in the old style of building bridges.

Where railroads are to be formed over frequently flooded or boggy land, a number of these cylinders laid side by side —as in Fig. 2—will, it is claimed, save railway companies the enormous cost of foundations. The cylinders having a continuous bearing the whole width of the railway cannot possibly sink very much, and the rail level would be made good on the top in case of any subsidence.

Light and Color.

BY ALFRED DANIELL, M.A., B.SC.

Light is a form of wave-motion in the all-pervading ether; and it scarcely needs, nor does space allow, a lengthened discussion of the varieties of converging proofs which aid one another in forcing us to this conclusion. If we throw a couple of stones on the surface of water, we find a couple of systems of rings produced, which at their points of crossing present the appearance of engine-turning. Where the crest of one coincides with the crest of the other, there is double upheaval; where the trough of one coincides with the trough of the other, there is double depression. Where, however, the crest of one coincides with the trough of the other, what do we find? Neutralization of effects—no effect, no motion; for the instant a state of rest. This is exactly what happens when two beams of light coming, or appearing to come from two points exceedingly near to one another, are allowed to shine upon the same spot. The phenomena of interference of light are phenomena in which light added to light produces darkness in some places, and extra brightness in others—darkness when the same spot is affected by waves which are in opposite places, and increased brilliancy when the waves are in accord with one another. This is a matter capable of easy explanation when the phenomena of light are considered as due to wave-motion; but under the old corpuscular material theory of light it was very difficult to explain, as indeed it was to understand or believe the explanation offered.

The phenomena of color are again due to waves of different lengths. Each color and shade of color, provided that it is in the spectrum, is due to a special wave-length. The waves of light which produce in our eyes the impression of deep red have a length of about the 37,640th part of an inch; and since the ripples of 192,000 miles of space break upon the eye in a second, we learn that during each second we spend in contemplating the planet Mars, or any red star, the prodigious number of 458,000,000,000,000 break upon the eye; and if the red object we look at be terrestrial, it must be in a state of continued vibration, which enables it during each second to start this enormous number of waves traveling through the ether and striking the eye. The other extreme in color is produced by certain violet rays, which have a wave-length of the 60,000th part of an inch, and of which more than 700,000,000,000,000 strike the eye during every second. But there are still more rapid vibrations, propagated by the ether, to which our eyes are not sensitive, but to which our photographic plates do respond; and there are vibrations, slower than those of the extreme red, to which our eyes are not specially sensitive, but which our skin and general bodily organisms perceive as heat rays. The slower waves are thus the cause of radiant heat, the more rapid ones cause the sensation of light, and the most rapid produce the chemical effects upon which photography depends. Yet there is no broad line of demarkation between these departments of energy-bearing waves. The red rays are felt to be warm by the hand, and seen by the eye to be red; the violent rays are seen by the eye to be violet, and are also found to be active in relation to photographic plates. What lies beyond these we do not know. There is no probable reason, in the nature of things, for such a limitation of vibrations in the ether to one or two octaves; but whether there be or be not any radiations through space which are slower or more rapid than those with which we are acquainted as heat waves, light-waves, or actinic waves, it remains that we do not know anything about them, for we have no senses which perceive them, and we have as yet discovered no instrumental means for their detection. Yet we suspect their existence. Many of the vibrations of luminous bodies are connected with one another in the same way as the harmonics of a low musical note are related; and thus we may, without any material call upon our imagination, suppose ourselves to be in relation to the vibrations of light in much the same position as we can easily suppose a grasshopper to be on listening to the boom of a church organ. The grasshopper can hear sounds which are beyond our hearing, sounds high and keen edged, sounds like those which he himself makes: but it is probable that we in our turn can hear low tones which the grasshopper cannot hear, and that on listening to a full-chorded combination of sounds, the insect would be deaf to the lower notes, and would hear simply a crowd of harmonics, which would seem at first to bear no relation to one another. In the same way, we can suppose ourselves to be blind and devoid of sensation in respect of those long fundamental waves in the ether, of which these light rays and heat rays are some of the harmonics. Too much stress must not be laid on this, however, because our knowledge (though growing) is not yet very great in this regard; and there is not much evidence that there is any material loss of recognizable or perceptible energy in the shape of unrecognizable or imperceptible radiations.

Color in the theory of light resembles pitch in the theory of sound. Both depend upon the length of wave which strikes upon the appropriate organ of sense after traveling through the appropriate medium. Yet though they depend upon the length of wave, the length of wave does not explain the sensations of color or pitch. The theory of light and that of sound are both, in the most rigid sense, sciences of calculation, of applied mathematics, mechanical sciences. They have nothing to do with the emotional effect of the harmony of colors or of sound; or with the relation between beauty of color or of sound, and the admiration which this calls forth from a sensitive mind. They have to deal with vibrations alone, and a transversal vibration in the ether, having a wave-length of the 51,110th of an inch, and falling on the retina of the eye, may or may not rouse the enthusiasm of the mind which is behind the eye that perceives the blue of heaven; but physical science, concerning itself with the vibration as such, and as such only, stops short where physiology and psychology take up the burden of discovery and of explanation.

White light, such as that which comes to us from the sun, is composed of almost all the vibrations within the limits of visibility, simultaneously traveling through space, and simultaneously striking our eyes. When a ray of bright white light strikes the eye, we have no sense of any special color in the mixture, and this is the sensation of white light; the mixed sensation of all colors, of which none preponderates, is the sensation of uncolored or white light. If an orchestra sounded forth every imaginable note within the compass of our hearing, the blinding flare would not produce in our ears the effect of any particular pitch; the result would simply be an indescribable Wagneresque ocean of pitchless sound. So it is, and as wonderful, but that we are more accustomed to it, every time we behold white light; and our object when we endeavor to procure what we call pure white light is to procure light which is due to all possible vibrations, of which no one preponderates over the other so as to impress the aggregate result with its own colored individuality.—*Journal of Gas Lighting.*

The American Association.

The annual meeting of the American Association for the Advancement of Science will take place at Montreal (not Buffalo as stated in our last), on Wednesday, Aug. 23, 1882.