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ANTHROPOMETRIC INSTRUMENTS

— AND —

HOW THEY ARE USED.

Department of Physical Education
WELLESLEY COLLEGE
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Compiled from an address by Dr. W. G. ANDERSON, and letters
from Dr. A. J. ANDREWS and Dr. ELIZA M. MOSHER.

DEPARTMENT OF
WELLESLEY COLLEGE
WELLESLEY, - MASSACHUSETTS

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ANTHROPOMETRIC INSTRUMENTS, AND HOW THEY ARE USED.

Compiled from an address by Dr. W. G. ANDERSON, delivered at the Brooklyn Normal School for Physical Education and letters from Dr. A. J. ANDREWS and Dr. ELIZA M. MOSHER.

The special committee, appointed by the American Association for the Advancement of Physical Education, to report on a system of physical measurements, recommend the use of dynamometers, or instruments for testing the strength of certain muscles or groups of muscles.

The old or cumbersome "lifts" or weights that were used at one period for this purpose have been replaced by accurate spring dynamometers, which are at the same time easily handled on account of their compactness and are exact in their markings.

It is at once seen why a beautifully made spring dynamometer, which weighs only a few ounces, is of more value than a weight lift that registers over 200 pounds. One can be carried in the hand, the other requires an express to move it. One will test the strength of hands, arms, chest, back, legs, or particular parts of the body; the other is generally used to show "how much one can lift."

Inasmuch as a very essential part of any one's physical education is based upon anthropometry, or the measurements of man, and as an important factor in anthropometry is the strength of muscles, it is therefore seen that all strength tests should be standard, so that at some time, if the various physical instructors will

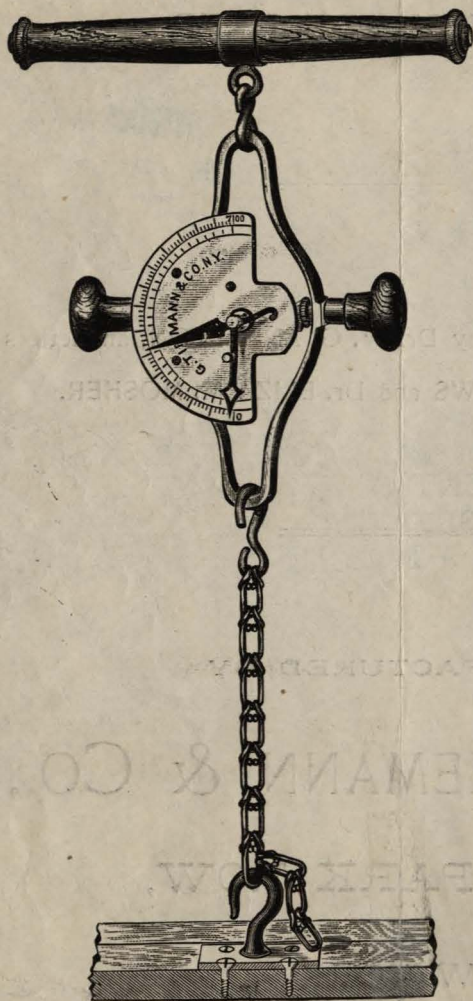


FIG. 1.

bring together the results of these tests, they will better serve to show the strength of the "typical man."

We take pleasure in calling your attention to the new and improved instruments made by JULIUS A. PFARRE, of the old and well-known firm of TIEMANN & Co., New York City, surgical instrument makers. They are arranged for the English and metric systems, are carefully tested and pronounced accurate.

The Dynamometer seen in Fig. 1 can be used first, to ascertain the

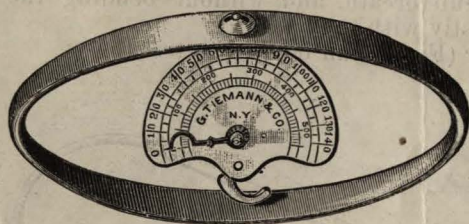


FIG. 2.

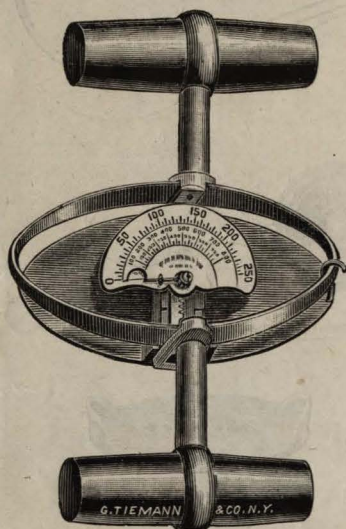


FIG. 3.



FIG. 4.

Strength of Chest.—The subject, with his elbows extended at the sides, until the forearms are on the same horizontal plane, and holding the dynamometer so that the dial will face outward and the indicator point upward, should take a full breath and push vigorously against the handles, allowing the back of the instrument to press on the chest.

The Dynamometer (Fig. 1) can be attached to the floor, and used to test the

Strength of Legs.—The subject, while standing on the foot-rest with body and head erect, and chest thrown forward, should sink down, by bending the knees, until the handle grasped rests against the thighs, then taking a full breath, he should lift hard, principally with the legs, using the hands to hold the handle in place.

Or, the same instrument can be used to test the

Strength of Back.—The subject, standing upon the iron foot rest with the dynamometer so arranged that, when grasping the handles with both hands, his body will be inclined forward at an angle of 60 degrees, should take a full breath, and, without bending the knees, give one hard lift, mostly with the back.

The Hand Dynamometer (Fig. 2) can be used to test the

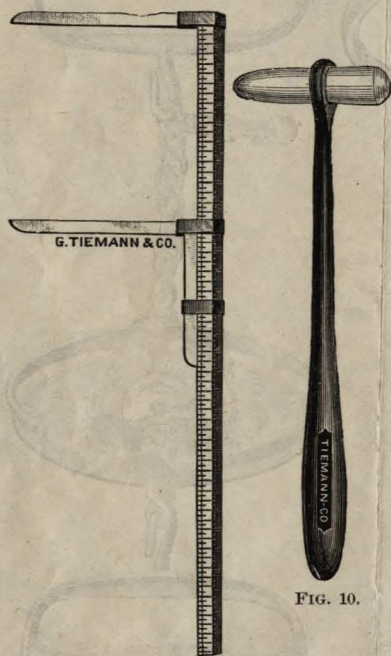


FIG. 5.



FIG. 10.

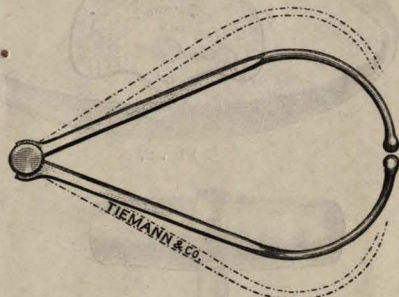


FIG. 6.



FIG. 9.



FIG. 11.

Strength of Forearms.—The subject, while holding the dynamometer so that the dial is turned inward, should squeeze the spring as hard as possible, first with the right hand, then with the left. The strength of the muscles between the shoulders may be tested with the same instrument. The subject, while holding the dynamometer on a level with the chest, should grasp it with handles and pull with both arms from the centre outward.

Handles are furnished with this dynamometer for the second test or for using it as a test of strength of the back and legs. The dial has two sets of markings.

Fig. 3 shows the "Push Holder," and Fig. 4 the "Holder for Pulling" to use with Hand-Dynamometer, of which Dr. A. J. Andrews writes:

"I have used these holders in several hundred cases during the passed few months with so much advantage and satisfaction that I feel that others, engaged in similar work, may find them useful. Until I had them made for me by Messrs. Tiemann & Co. I did not secure as much accuracy as I desired, either in the examination of



FIG. 13.

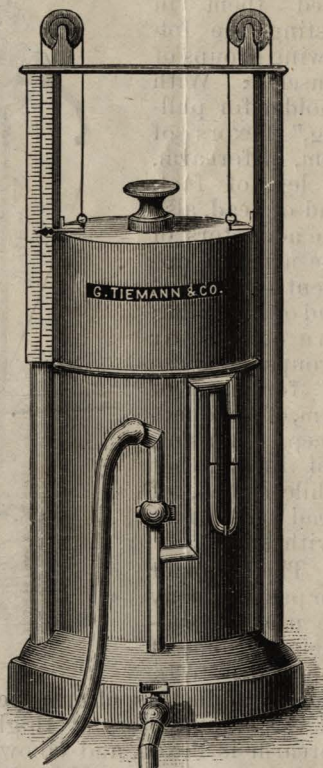


FIG. 8.

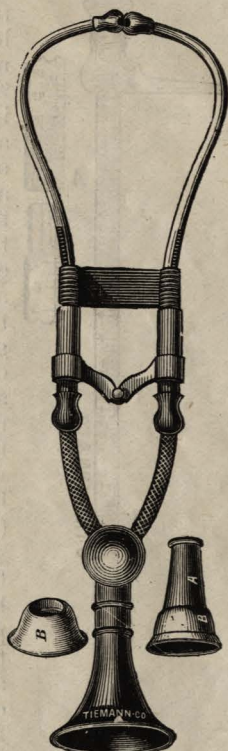


FIG. 12.

candidates for positions in the Civil Service of Brooklyn, or in patients, and had no means for accurately measuring deficient or defective groups of muscles.

The Hand-Dynamometer is placed in either of the frames, dial outwards; in some tests both handles are held by patients, in others one is held by the operator or examiner and the other by patient (or may be affixed to a hook in the floor or wall), or in the "push" holder, one handle may be applied against any portion of patient's body, while the other is held by the operator; in still other tests it

is necessary to have a strap with a hook, as in testing the muscles of the neck with the "pull" holder, in many tests it is also necessary to prevent the patient from influencing the result with his weight.

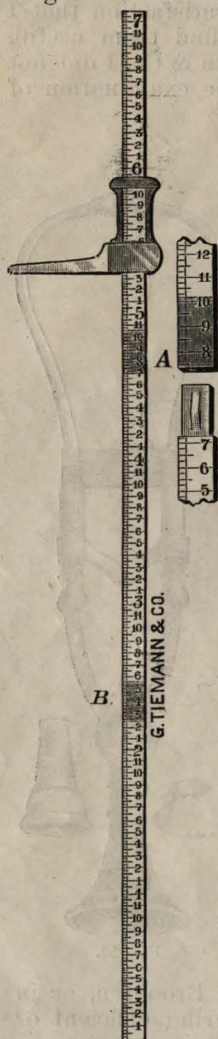


FIG. 7.

I have found these tests useful in recording the progress in lead palsy or nerve injuries, and have used them in testing the following groups of muscles: With "holder for pulling," flexors of arm, of forearm, of leg, of foot, and of head, also the adductors of the arm (in different directions) and of the thigh; the extensor groups, as those of forearm, of arm, of leg (quadriceps extensor), not lifting, but while seated, of head and of foot (with strap).

The "holder for pushing" may be used to supplement some of the above tests, and for adductors of arm (pectorals, etc.), flexors of thigh, adductors of thigh, and of arm while forearm is flexed, and elbow at side, and holder is between inner side of patient's arm and examiner's hand which is on patient's side; and may also be used in testing power of muscles which raise hand from shoulder straight up above head (part of trapezius, deltoid, serratus magnus, triceps, etc.)

And lastly the pulling frame may be used for testing the accuracy of the dynamometer itself by hanging it from a hook, and applying carefully a known weight, (and for weighing people where they are strong enough to hold handles or examiner has provided a seat or strong hook)."

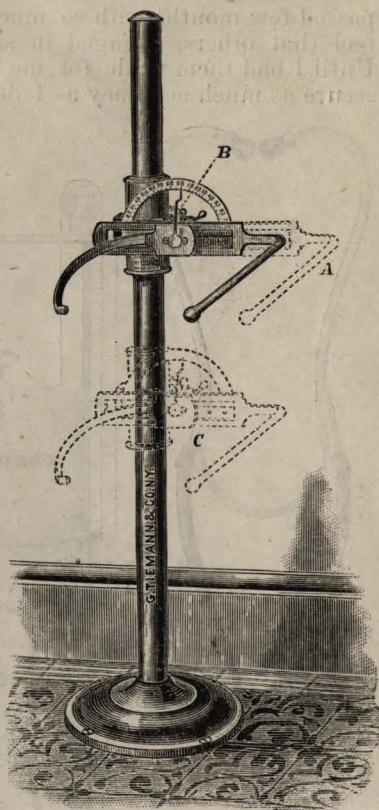


FIG. 14.

The Slide, seen in Fig. 5, is used to take the

Breadth of Head.—The breadth of head should be taken at the broadest part. In taking the head measurements, stand behind the subject.

Breadth of Neck.—Taken at the narrowest part, with the head of the subject erect and the muscles of the neck relaxed.

Breadth of Shoulders.—With the subject standing in a natural position, elbows at the side, shoulders neither dropped forward nor braced backward, measure the broadest part two inches below the acromion processes.

Breadth of Waist.—Taken at the narrowest part.

Breadth of Hips.—Measure the widest part over the trochanters, while the subject stands with feet together, the weight resting equally on both legs.

Breadth of Nipples.—Taken from centre to centre with the chest in a natural position. This instrument registers both the English and the metric system.

For taking the depth of the various parts of the trunk, the nickel-plated calipers are used (see Fig. 6). They are curved to conform to the lines of the body.

Depth of Chest.—Taken after a natural inspiration. Place one foot of the calipers on the sternum, midway between the nipples, and the other foot on the spine at such a point that the line of measurement is at right angles with the axis of the spinal column. When it is desirable to ascertain the extent of the antero-posterior movement of the chest, measurements may be taken from the same points after the fullest inspiration and after the fullest expiration.

Depth of Abdomen.—Place one foot of the calipers immediately above the navel, the other on the spine at such a point that the line of measurement is at right angles to the axis of the spinal column.

The Height Tester can be purchased in one piece, or it is so arranged that it can be taken to pieces (see Fig. 7). It registers the English and metric system.

Height.—The height should be taken without shoes and with the head uncovered. The head and figure should be held easily erect, and the heels together. This position is best secured by bringing the heels, the buttocks, the spine between the shoulders and the back of the head in contact with the measuring rod.

The Spirometer, Hutchinson's model, is the most accurate. It is made on the principle of the gasometer (see Fig. 8).

Capacity of Lungs.—The subject, after loosening the clothing about the chest and taking a full inspiration, filling the lungs to their utmost capacity, should blow slowly into the spirometer. Two or three trials may be allowed.

Extreme Breathing Capacity.—By the extreme breathing capacity is meant the volume of air that can be expelled from the lungs by the most forcible expiration. This has been called by Dr. Hutchinson the *vital capacity*, as signifying the "volume of air which can be

displaced by living movements." Its volume is equal to the sum of the reserve air, the breathing and the complementary air, and represents the extreme capacity of the chest, deducting the residual air. Its physiological interest is due to the fact that it can be determined by an appropriate apparatus, the Spirometer, and comparisons can thus be made between different individuals, both healthy and diseased. The number of observations on this point by Dr. Hutchinson is enormous, amounting in all to little short of *five thousand*.

The following table shows the normal capacity of the healthy lung:

HEIGHT.		MALE CAPACITY.		FEMALE CAPACITY.	
4 feet	8 inches,	134	cubic inches.	96	cubic inches.
4 "	9 "	142	"	104	"
4 "	10 "	150	"	112	"
4 "	11 "	158	"	120	"
5 "	0 "	166	"	128	"
5 "	1 "	174	"	136	"
5 "	2 "	182	"	144	"
5 "	3 "	190	"	152	"
5 "	4 "	198	"	160	"
5 "	5 "	206	"	168	"
5 "	6 "	214	"	176	"
5 "	7 "	222	"	184	"
5 "	8 "	230	"	192	"
5 "	9 "	238	"	200	"
5 "	10 "	246	"	208	"
5 "	11 "	254	"	216	"
6 "	0 "	262	"	224	"

Strange as it may seem, Dr. Hutchinson's experiments show that the height of the individual, instead of the circumference of the chest, governs the lung capacity in the normal lung. This seems the more remarkable from the fact that the height does not depend so much upon the length of the body as upon the length of the lower extremities. It will be seen by this table that for every inch in height between 5 and 6 feet, that the breathing capacity is increasing 8 inches. It is also true that the extreme breathing capacity is constant in the same individual and cannot be increased except where the lungs are weak or diseased. A slight allowance must be made for age, as it has been shown that the capacity slightly increases up to the 30th year, and very gradually decreases from the 30th to the 60th year. This table gives the average capacity in a large number of healthy lungs in people of certain heights.

Fig. 9 shows the Tape used in taking measurements.

Fig. 10 is the Pleximeter, and Fig. 11 the Percussor, used to test the lungs.

Fig. 12, Stethoscope, Camman's.

Fig. 13, the Albion Stethoscope (see cut), which many of our most prominent teachers in physical diagnosis consider superior to Camman's in some respects, and more desirable because it can be conveniently carried in the pocket without detaching the tubing.

Fig. 14, a Pelvic Obliquimetre by Dr. Eliza Mosher. A relation more or less intimate has been observed by a number of gynaecologists between the habitual posture of the pelvis in women and the health of the organs which are suspended within it.

Dr. Eliza M. Mosher, of Brooklyn, N. Y., in a paper read before the Gynaecological Section of the Pan-American Congress, held in Washington, in 1894*, presented some important statistics upon this subject. In order to obtain the data necessary she was obliged to devise an instrument with which to measure the obliquity of the pelvis. This instrument she named a Pelvic Obliquimetre. It was made by us, and the accompanying cut shows it in improved form.

By placing the stationary arm with its point at the lumbo sacral articulation, and the movable arm at the top of the pubis, the angle at which the brim of the pelvis is held will be indicated by the needle which moves over a half circle divided in degrees for convenient counting.**

This instrument is of value to the gynaecologist, and to the director of gymnasia for girls. Symptoms of disturbance traceable to the pelvic organs, especially in young girls, may be considered serious or otherwise, according as the habitual angle of obliquity approaches or recedes from the normal.

This instrument makes it possible to demonstrate habits of posture which tend to produce ill health by actual measurement, and it is easy thereby to place the body in exact normal poise.

The Obliquimetre is in use in the gymnasia of several colleges as well as in the private offices of physicians.

CALIPERS FOR CRANIAL MEASUREMENTS.

By FREDERICK PETERSON, M. D.

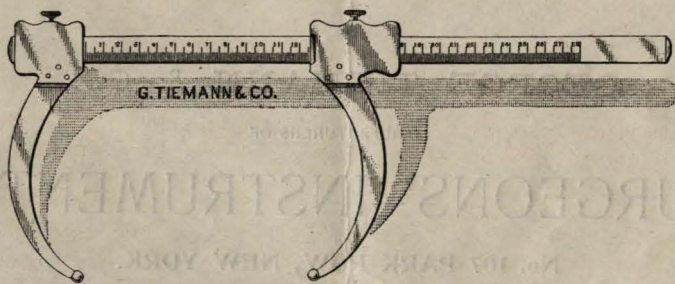


FIG. 15.

Those interested are referred to Dr. Peterson's article on Craniometry and Cephalometry in *American Journal of Insanity* for July, 1895.

* "Habit of Posture a Cause of Deformity and Displacement of the Uterus."

** Dr. Mosher's original instrument marked the angle a little differently from that obtained by this improved machine.

PRICE LIST

OF INSTRUMENTS DESCRIBED.

FIG.

1.	Dynamometer for Back, Chest and Legs	-	-	-	-	\$50.00
2.	Dynamometer for Hand	-	-	-	-	10.00
	The same, with Handles for Traction	-	-	-	-	12.00
3.	Andrews' Push Holder	-	-	-	-	10.00
4.	" Holder for Pulling	-	-	-	-	10.00
5.	Sliding Measure, for Head, Shoulders, etc.	-	-	-	-	3.00
6.	Nickle Plated Calipers	-	-	-	-	2.50
	Anderson's Improved, with scale reading inches and centimetres	-	-	-	-	5.50
7.	Height Measure, in 3 Sections	-	-	-	-	10.00
	Height Measure, in one piece	-	-	-	-	8.00
8.	Hutchinson's Spirometer	-	-	-	-	32.00
9.	Steel Tape Measure, reading inches and centimetres: 3 feet long	-	-	-	-	
	(1 metre)	-	-	-	-	1.50
	5 feet long (1.5 metre)	-	-	-	-	2.25
	6 " " (2 metres)	-	-	-	-	3.00
10.	Flint's Percussor	-	-	-	-	.75
11.	" Pleximeter	-	-	-	-	.35
12.	Camman's Improved Stethoscope	-	-	-	-	4.00
13.	Albion Stethoscope	-	-	-	-	3.00
14.	Mosher's Pelvic Obliquimetre	-	-	-	-	50.00
15.	Peterson's Calipers	-	-	-	-	10.00

GEORGE TIEMANN & CO.,

MANUFACTURERS OF

SURGEONS' INSTRUMENTS,

No. 107 PARK ROW, NEW YORK.

Instruments of our manufacture have our name stamped upon them, and we make none without so stamping them.

Branch Store: STOHLMANN, PFARRE & CO., 107 East 28th Street, New York.

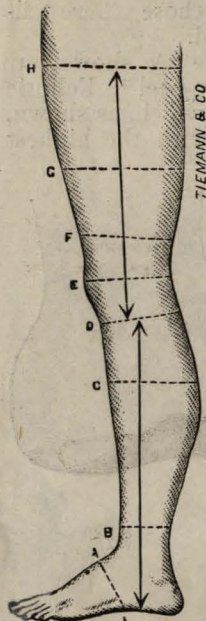
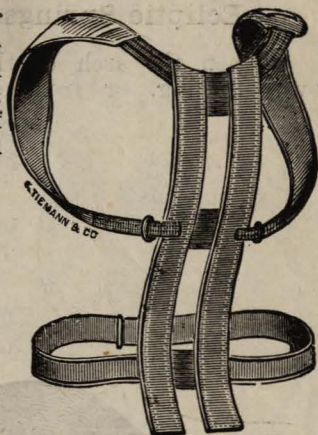
WE carry in stock and make to order
Shoulder Braces for round shoulders,
Elastic Hose, Wristlets, Elbow and
Shoulder pieces for sprained joints, etc.;
also Braces for the support and aid of
functional impairments of the spine and
limbs.

Steel Back Shoulder Brace for Round Shoulders.

DIRECTIONS FOR MEASUREMENT.

1. Patient's name (or sex).
2. Crest of ilium to axilla.
3. Circumference of pelvis.
4. Circumference of chest under axilla.

Price, \$4.00 to \$5.00.



Silk and Cotton Elastic Hose.

DIRECTIONS FOR MEASURING.

Indicate the *exact* measure around the limb, in inches, opposite the dotted lines on the cut (we allow for pressure). Also give the length of stocking from floor or plane upon which the foot rests.

Prices (single leg).

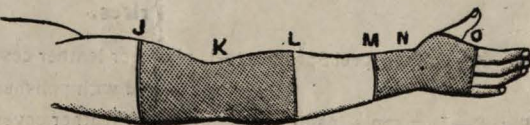
	Best Silk.	Fine Silk.	Cotton.
Thigh Hose, to <i>H</i>	\$12.00	—	\$6.00
Half Thigh Hose, to <i>G</i>	10.00	\$8.00	5.50
Knee Hose, to <i>F</i>	8.00	6.00	3.00
Three-quarter Hose, to <i>D</i>	4.50	3.50	2.00
Knee Cap, <i>D</i> to <i>F</i>	3.50	3.00	1.75
Anklelets, <i>A</i> to <i>B</i>	3.00	2.50	1.75

Other qualities and lengths at prices to correspond.

For Gauntlet, measure
at *M*, *N*, *O*.

For Wristlet, measure
at *M* and *N*.

For Elbow piece, meas-
ure at *J*, *K*, *L*.



Prices.

	Best Silk.	Fine Silk.	Cotton.		Best Silk.	Fine Silk.	Cotton.
Gauntlet	\$2.50	\$2.25	\$1.75	Elbow Piece...	\$2.75	\$2.50	\$2.00
Wristlet	1.75	1.25	1.00	Shoulder Cap..	7.00	6.00	5.00

Ecliptic Springs and Insoles for Flat Feet.

When the arch of the foot has broken down, either from over-straining, or from a relaxed condition of the muscular structures so that the entire sole touches the floor when standing, great relief and in many cases a cure follows the replacing of the bones and holding them in their normal position.— Various devices have been constructed for this purpose.

The most satisfactory ones are, in our experience those here illustrated.

Figure A shows our “Orange-peel” Ecliptic Spring, which, as shown,

is fastened near the outer edge of the shoe with the highest edge at the inner side of the shoe.

Figure B represents our new model Tie-mann’s Insole.

This is fitted accurately to the foot and simply placed in the shoe; it retains its position perfectly and can be changed from one shoe to another.

When ordering send “laced” shoes, and if possible a cast or impression of foot.

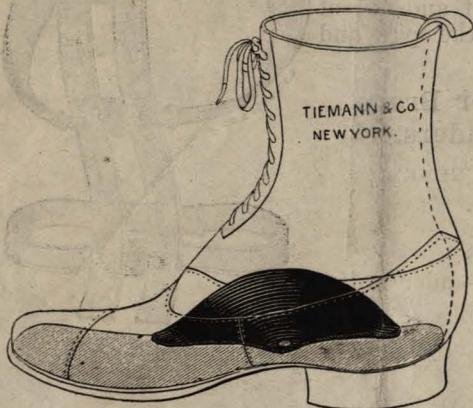


FIG. A.

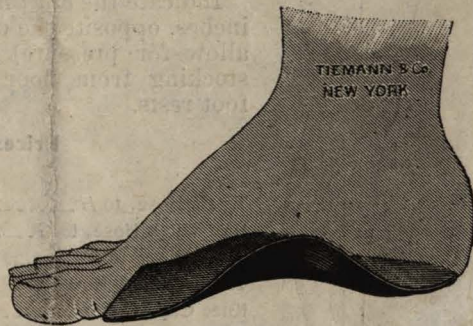


FIG. B.

Prices.

Per Pair.

Fig. A—Orange-peel Spring, steel, plated or leather covered	\$3.00
“ — “ “ “ covered with polished hard rubber	5.00
Fig. B—Tiemann’s Insole, steel, plated or leather covered	5.00
“ — “ “ “ covered with polished hard rubber	8.00

NB.—Hard rubber covering prevents rusting of the spring from perspiration.