

CATALOG B

1930

CHRONOGRAPHS AND ACCESSORIES



The
GAERTNER SCIENTIFIC CORPORATION

SUCCESSOR TO WM GAERTNER & CO.

ESTABLISHED 1896



INCORPORATED 1923

1201 WRIGHTWOOD AVENUE
CHICAGO, U. S. A.

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The Gaertner Scientific Corp.

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CHRONOGRAPHS AND ACCESSORIES



TAPE CHRONOGRAPHS

DRUM CHRONOGRAPHS

PRINTING CHRONOGRAPHS

RECORDING DRUMS AND ACCESSORIES

RECORDING PAPERS

REGULATOR CLOCKS AND CHRONOMETERS

STOP WATCHES

INTERVAL TIMERS

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SALES CONDITIONS

Ordering. Orders should be in writing and preferably on our regular forms. Verbal orders are accepted but will have to be verified in writing to avoid possible mistakes. All quotations and acceptances of orders are made with mutual understanding that orders are not subject to cancellation.

Illustrations, Specifications and Weights as given in the Catalog are not always absolutely correct. Changes in construction owing to improvements are sometimes made and notice of such changes is given only if the changes affect the usefulness of the article or any accessories used in connection with it.

Prices. The prices are Net from our factory, are subject to change without notice, and do not include packing and transportation to railroad stations, except when stated in our quotation.

Payments are due in 30 days from date of invoice, payable in U. S. Dollars. Overdue accounts are subject to interest charges. Customers not having an account with us and not commercially rated, are expected to send remittance with order or satisfactory references.

Packing is done with the greatest care by experienced packers and is charged for at cost.

Shipments are made in accordance with instructions from the customer, but in case no definite information is given, we use our best judgment as to the method of shipment. Shipments are made at the risk of the consignee but all goods are insured against damage in transportation and charged at cost to the customer. Exceptions are only made if we are notified when the order is placed or before it is shipped.

Deliveries. Our patrons will appreciate that, owing to the great variety of instruments which we manufacture, the demand for many of them being comparatively small from the standpoint of production, and requiring a great deal of highly skilled labor, it is not always possible to fill orders with unvarying promptness. Such instruments and accessories for which there is a regular demand, are usually kept in stock and orders therefore can be filled promptly. It is impracticable to complete the more expensive instruments and keep them on hand, as the demand is not regular, and experience teaches us that the customer often demands certain changes or special attachments to meet his individual preferences and needs. We have made it a practice to keep parts for many of such instruments on hand in unfinished condition, and are often able to ship these instruments promptly. Delays in delivery give the customer no right to claim damages.

Guarantee. All goods supplied are carefully inspected prior to shipment and any defect due to material and workmanship or any shortage of which we are notified within a reasonable time, will be promptly corrected. Before returning any goods we will furnish the necessary information regarding the method of shipment, packing, etc. Instructions for operation and care are furnished with each instrument and the customer is assured of any further help found necessary. We assume, however, no responsibility for any damage resulting from improper handling, etc. If instruments are constructed according to specifications furnished to us, we cannot be responsible for results obtained.

INTRODUCTION

The Chronographs and accessories listed in this catalog are intended for recording time intervals of practically any duration, and will be found useful and often necessary, in every kind of Laboratory, in Astronomical Observatories, in Industrial Establishments, for recording Sporting Events, etc. Various types of instruments are offered for timing intervals as small as hundredths of a second and less or intervals of many hours duration.

Our Chronographs are finding a great variety of applications, only a few of which we mention:

1. Study and Analysis of the action of intricate machinery.
2. Recording the action of a Machine Gun Mechanism, and simultaneously counting the shots.
3. Determination of the speed of Torpedos.
4. Timing of automobile races.
5. Timing of all kinds of races and speed tests.
6. Recording of traffic on highways and streets.
7. Determination of the burning time of detonating fuses.
8. Determination of velocities of circular or linear motion.

For marking the short intervals of time an accurate tuning fork is employed. Our forks are accurately calibrated to within $1/10$ of 1% by comparison with a standard fork which was kindly calibrated for us by Dr. D. C. Miller of the Case School of Applied Science. For marking longer intervals one of the pens of the chronograph is connected to a chronometer or a Regulator clock. We can furnish high-grade regulator clocks of practically any accuracy desired, up to three seconds per month. Where controlled A.C. is available time intervals can be measured according to the change of cycles, either by operating the chronographs from a Telechron Motor and determining the time by directly measuring the distance upon the record, or, if the paper speed is rapid, by marking the time with the Electric Time Marker which can be operated from a small Transformer to vibrate with the change of cycles. These methods are applicable where electric clocks can be used; they are very convenient but for a high degree of accuracy in marking time intervals a regulator clock, a chronometer, or a tuning fork is necessary.

We take pleasure in presenting to our friends and customers throughout the world, this new catalog listing our line of Time Recording Instruments, which are well known for their high standards of accuracy and for their dependability and great convenience of operation. Before an instrument leaves our works it is subjected to a rigid practical test in our laboratory. We shall continue to embody in our instruments the same high grade materials and the same painstaking care in design and workmanship which, for over thirty-three years the name **GAERTNER** has signified upon scientific instruments of the highest class.

In concluding, we consider it our pleasant duty to thank our many old friends and patrons for their gratifying support in the past, and we take this occasion to assure them of our earnest desire to merit their continued patronage in the future.

THE GAERTNER SCIENTIFIC CORPORATION

Successor to Wm. Gaertner & Company

Below we give a list of some of the users of our different types of Chronographs:

U. S. Naval Observatory, Washington, D. C.
U. S. Coast and Geodetic Survey, Washington.
Bureau of Standards, Washington, D. C.
Naval Research Laboratory, Bellevue, Anacostia, D. C.
U. S. Department of Agriculture, Washington, D. C.
Springfield Armory, Springfield, Massachusetts.
Dominion Observatory, Ottawa, Canada.
Observatorio Nacional, Rio de Janeiro, Brazil.
Northwestern University, Evanston, Illinois.
Ohio State University, Columbus, Ohio.
University of Chicago, Chicago, Illinois.
University of California, Berkeley, California.
Amherst College Observatory, Amherst, Massachusetts.
Catholic University of America, Washington, D. C.
University of Illinois, Urbana, Illinois.
University of Minnesota, Minneapolis, Minnesota.
University of Mississippi, University, Mississippi.
Miami University, Oxford, Ohio.
University of Pittsburgh, Pittsburgh, Pennsylvania.
Washburn Observatory, Madison, Wisconsin.
Wheaton College, Wheaton, Illinois.
Albion College, Albion, Michigan.
Carleton College, Northfield, Minn.
National Aeronautics Association of U. S. A., Washington, D. C.
U. S. Navy Yard, Washington, D. C.
U. S. Air Corps, Dayton, Ohio.
City of Daytona Beach, Florida.
Amtorg Trading Corporation, New York, N. Y.
Futaba and Company, Ltd., Tokyo, Japan.
General Electric Company, West Lynn, Massachusetts.
George Peabody College, Nashville, Tennessee.
Western Electric Company, Chicago, Illinois.
Westinghouse Electric & Mfg. Co., Springfield, Massachusetts.
Linde Air Products Company, Buffalo, New York.
Metric Metal Works, Erie, Pennsylvania.
Niagara Falls Power Company, Niagara Falls, New York.
New York, New Haven and Hartford R. R. Co., New York, N. Y.
RCA Communications, Inc., New York, N. Y.
Takata and Company, Tokyo, Japan.
Mitchell Field, Garden City, Long Island, N. Y.

TAPE RECORDING CHRONOGRAPHS Specifications

This type of Chronograph has become widely used during the last years on account of its great convenience and varied adaptability for practically every time recording requirement. The use of the coated paper for receiving the records obviates the need of ink or pencil and assures a clean, uniform, and durable record mark. This coated paper is now available in rolls at a reasonable price, not much above that of the plain paper. The chronographs are furnished with a great variety of speeds for the paper tape and can be adapted for recording the smallest time intervals of one thousandth of a second as well as slower events several minutes apart. A tuning fork of 100 vibrations is used for recording the small intervals and the paper may be made to travel at a rate as high as one meter per second. For longer intervals one of the recording pens is operated by the electric contact made on a Regulator Clock, Chronometer, or other external timing device. The width of the paper is 28mm except when the instrument is equipped with four or more recording pens, in which case a paper tape 52mm wide is used. The length of the paper roll is about 100 meters.

The paper feeding device is carefully designed and consists of an accurately corrugated brass roller and a second roller covered with rubber, which is kept in contact with the corrugated roller by spring pressure. The two rollers are of exactly equal diameter and to assure precise paper feed they are geared together. The gears are encased. The rubber covered roller can be engaged or disengaged and the feed of the paper started or stopped instantly by the throw of a lever handle within convenient reach.

The rotation of the paper feeding device is given by one of the following devices:

1. An **Electric Motor of Universal type** for A.C. or D.C., of standard 110 voltage, or
2. An **Electric Motor for 12 volts D.C.**, or
3. A **Warren Telechron Motor** to operate on 110 volts 60 cycles A.C., for slow paper feeds, from 1 to 20mm per second.
4. For cases where an electric current is not available, we also furnish these Chronographs with a **spring motor drive**.

The speed of the paper can be regulated on Chronographs fitted with Universal or 12-volt D.C. Motors by an adjustable rheostat which gives a considerable variation in speed.

The Chronographs with electric motors of the Universal type or with 12 volt motors are equipped with worm reducing gears fully enclosed and running in oil. A double cone pulley is attached to the motor shaft and transmits the rotation to the paper feed roller by means of a V-shaped belt. The belt tension can be regulated by means of an adjustable roller in contact with the belt.

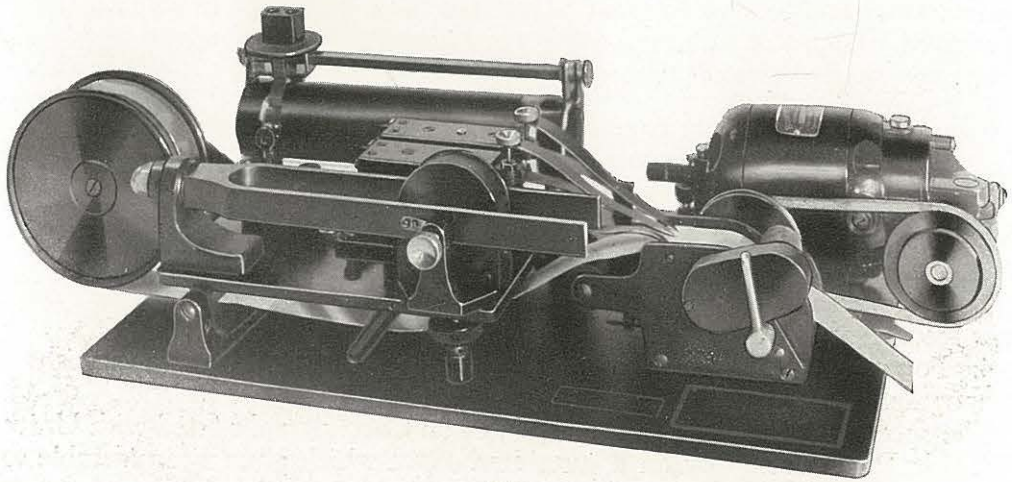
The recording pens are made of tempered steel and the pressure of each pen against the paper can be independently adjusted. The pressure of the pens is regulated by a screw attached to the base of the instrument, on which the platform holding the recording mechanism is mounted. The platform with the recording pens and tuning fork and paper roll is hinged on one end and is turned upward when it is necessary to insert a new roll of paper. A hinged support leg automatically falls in place and keeps the platform up.

The recording pens are operated by strong electromagnets which require a voltage of from three to four volts. The amount of throw of the pens and the spring tension can be conveniently adjusted. All delicate parts are enclosed.

If the chronograph is intended to record accurate time events, a Regulator Clock or Chronometer, fitted with electric contact device, is connected to one of the recording pens and will give the time signals, usually every second. An accurately rated, strong tuning fork of 100 vibrations, electrically maintained, is furnished with the Chronographs when it is desirable to record high velocities or very small time intervals. The rating of the fork is correct to within 1/10% at a temperature of 70° F. A voltage of three to four volts (current of .3 amperes) is required for operating the electromagnet of the fork.

When an accurately controlled alternating current is available and the speed of the paper need not exceed 10mm per second, the Warren Telechron Motor is recommended. By the use of these Motors a uniform paper speed is assured and a Regulator Clock or Chronometer will not be required. The distance between the record marks is most conveniently measured with a millimeter scale and thus the time is directly obtained.

With the Chronograph equipped with 110 or 220 voltage Motor, five feet of connecting cord with standard Edison plug is furnished. Five rolls of paper are supplied with every chronograph.



A373

A370 Chronograph, with one recording pen and a tuning fork of 100 v.p.s., **12 volt Motor Drive**, with rheostat for regulating paper speed from about 100cm to 20cm per second. Complete with five rolls of recording paper, 28 mm wide.....\$275.00

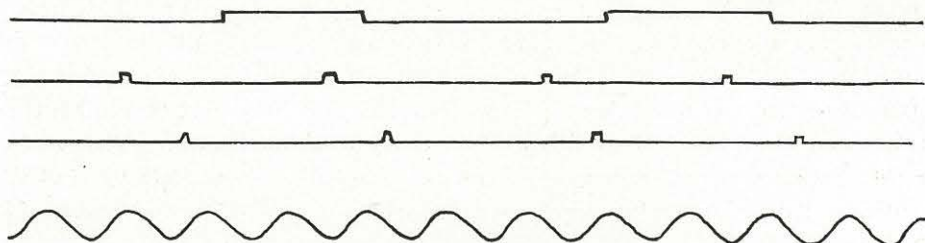
A371 Chronograph, with one recording pen and a tuning fork of 100 v.p.s., **Universal Motor Drive**, with rheostat for regulating paper speed from about 100cm to 20cm per second. Complete with five rolls of recording paper, 28mm wide..... 275.00

A372 Chronograph, with two recording pens and a tuning fork of 100 v.p.s., **12 volt Motor Drive**, with rheostat for regulating paper speed from about 100 cm to 20cm per second. Complete with five rolls of recording paper, 28mm wide..... 320.00

CHRONOGRAPHS AND ACCESSORIES

A373 Chronograph, with two recording pens and a tuning fork of 100 v.p.s., **Universal Motor Drive**, with rheostat for regulating paper speed from about 100cm to 20 cm per second. Complete with five rolls of recording paper, 28 mm wide..... 320.00

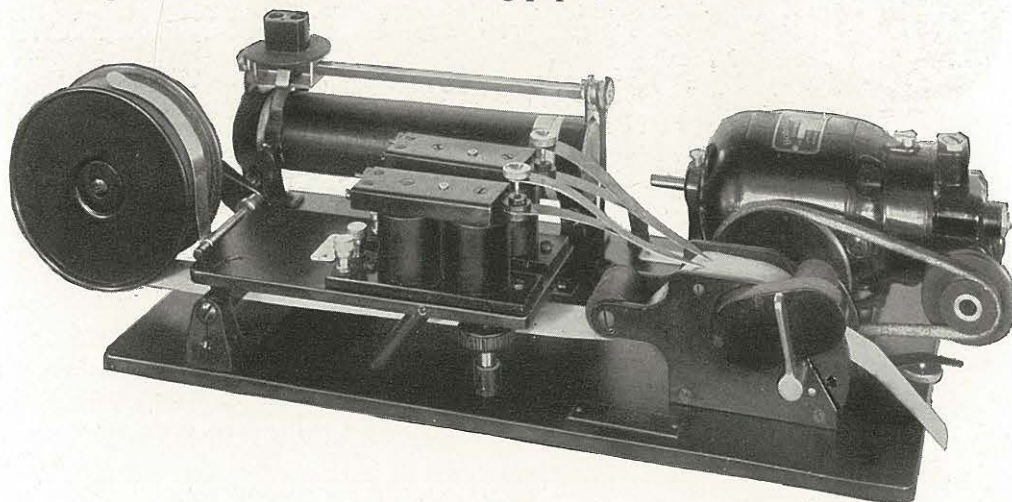
A374 Chronograph, with three recording pens and a tuning fork of 100 v.p.s., **12 volt Motor Drive**, with rheostat for regulating paper speed from about 100cm to 20cm per second. Complete with five rolls of recording paper, 52mm wide..... 380.00



Sample Record of Chronograph A374

A375 Chronograph, with three recording pens and a tuning fork of 100 v.p.s., **Universal Motor Drive**, with rheostat for regulating paper speed from about 100cm to 20cm per second. Complete with five rolls of recording paper, 52mm wide..... 380.00

A376 Chronograph, with two recording pens, **12 volt Motor Drive**, with rheostat for regulating paper speed from about 25mm to 5mm per second. Complete with five rolls of recording paper, 28mm wide..... 250.00



A377

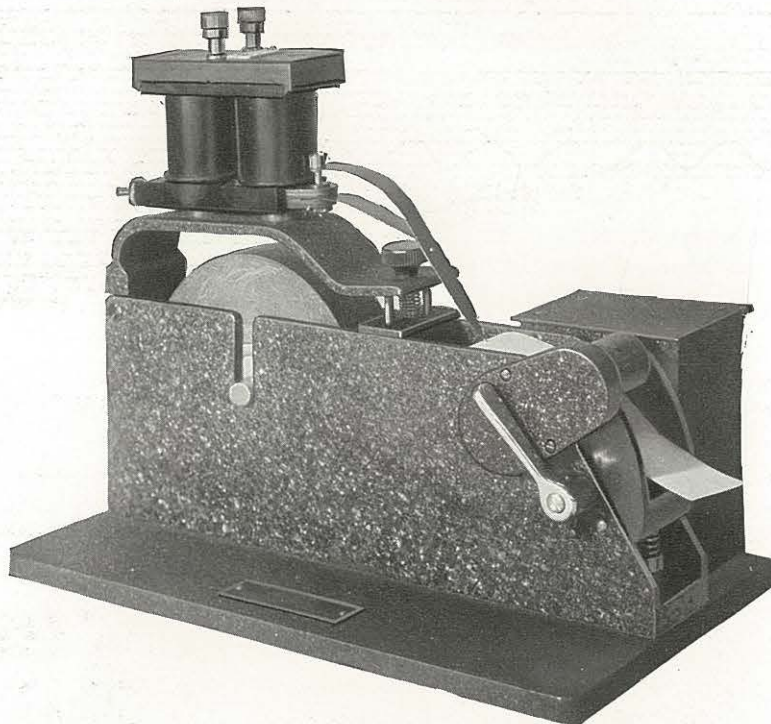
A377 Chronograph, with two recording pens, **Universal Motor Drive**, with rheostat for regulating paper speed from about 25mm to 5mm per second. Complete with five rolls of recording paper, 28mm wide..... 250.00

A378 Chronograph, with three recording pens, **12 volt Motor Drive**, with rheostat for regulating paper speed from about 25mm to 5mm per second. Complete with five rolls of recording paper, 28mm wide..... 300.00

A379 Chronograph, with three recording pens, **Universal Motor Drive**, with rheostat for regulating paper speed from about 25mm to 5mm per second. Complete with five rolls of recording paper 28mm wide..... 300.00

A381 Chronograph, with four recording pens, **Universal Motor Drive**, with rheostat for regulating paper speed from about 25mm to 5mm per second. Complete with five rolls of recording paper 52mm wide..... 360.00

A382 Chronograph, with four recording pens, **12 volt Motor Drive**, with rheostat for regulating paper speed from about 25mm to 5mm per second. Complete with five rolls of recording paper 52mm wide 360.00



A390

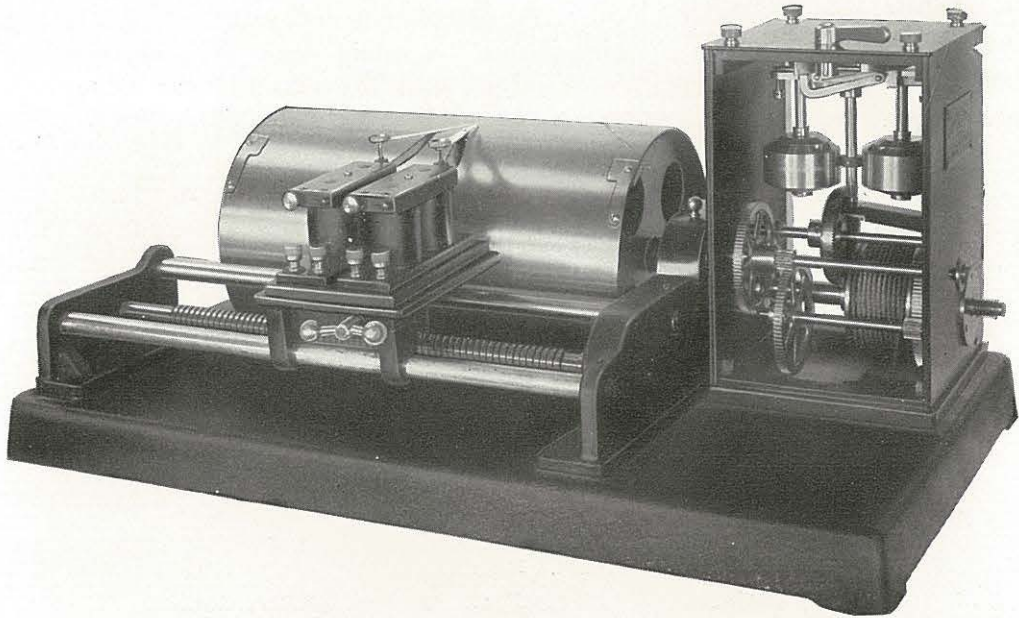
A390 Chronograph with Telechron Motor, fitted with one recording pen. The paper tape is 28mm wide and 120 meters long, and is shifted through a corrugated roller operated by the Telechron Motor at the rate of 60mm per minute. As the speed of the Telechron Motor is uniform, the time intervals of the events can be measured direct with a rule. The electromagnetic recording pen operates on 3 to 4 volts..... 180.00

A392 Chronograph with Telechron Motor, fitted with two recording pens. This instrument is the same as A390 but has two recording pens..... 220.00

A394 Chronograph with Telechron Motor, fitted with three recording pens. This instrument is the same as A390 but has three recording pens.... 260.00

Note—The Chronographs can be furnished with a more powerful Telechron Motor for higher speeds up to 20mm paper feed per second. Prices on application.

DRUM CHRONOGRAPHS



A352

A350 Drum Chronograph with One Recording Pen. The chronograph is fitted with a powerful driving clock with improved friction governor, having the arms made of "invar" steel. The governor will permit extremely close regulation and the compact construction and method of adjustment guarantees permanency of regulation and shipment without danger to the adjustments. The gears are carefully cut and the shaft of the driving drum runs in ball bearings.

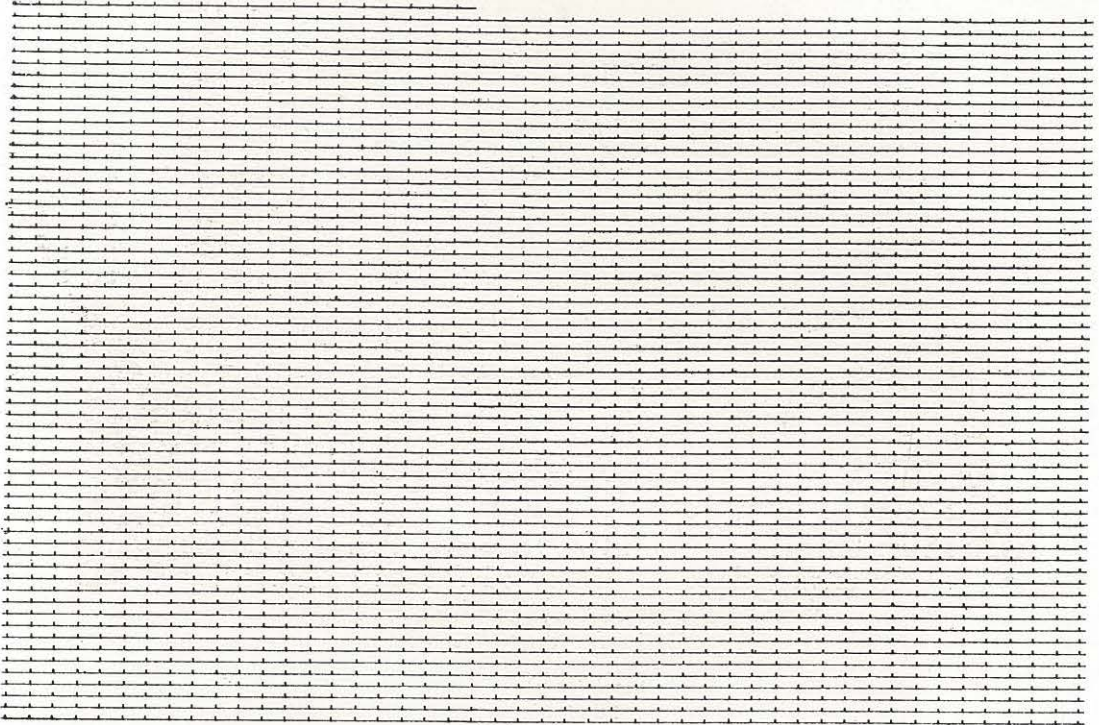
The clock is entirely enclosed by heavy plate glass sides and a starting and stopping lever is conveniently arranged on top of the clock. A clutch also is provided for engaging or disengaging the clock while running with the driving gears for drum and recording pen carriage. These gears are also protected from dust and injury by a suitable guard.

The drum is 6" (152.4mm) in diameter and 11" (275mm) long, and by means of a set of change gears can be made to rotate at a speed of 60 seconds or 30 seconds per revolution. At the slow speed the second intervals are exactly 8mm long.

The recording paper used on this instrument is coated and requires no ink for the recording pen which consists of a light steel stylus operated by an electromagnet on either open or closed circuit, 3-4 volts. All moving parts are carefully enclosed and the adjustments are conveniently arranged. The carriage with electromagnet, etc., travels on two cylindrical, steel, chromium plated rods and a lead screw between the rods transmits motion at the rate of 4mm per revolution of drum. A lever in convenient reach permits the disengaging of the carriage from the lead screw at the same time lifting the pen from the drum. Including 100 sheets of record paper (coated)..... \$460.00

A352 Drum Chronograph with Two Recording Pens. The chronograph is of exactly the same construction as the preceding one but is fitted with two recording pens. Including 100 sheets of record paper.....\$500.00

A354 Drum Chronograph with Three Recording Pens. The chronograph is of the same construction as A350 with the exception of being fitted with three recording pens. Including 100 sheets of record paper..... 540.00



Etching made direct from one of our chronograph sheets (reduced about 8:3) showing the accuracy of the clock work

A360 Reading Scale for Chronograph Records. The scale is divided on a beveled strip of nickel-silver; the length of graduations (480mm lines) corresponds to one revolution of the drum—60 seconds—and each division is equal to 1/10 of a second. Every second is numbered. The scale is convenient for reading records quickly and accurately 10.00

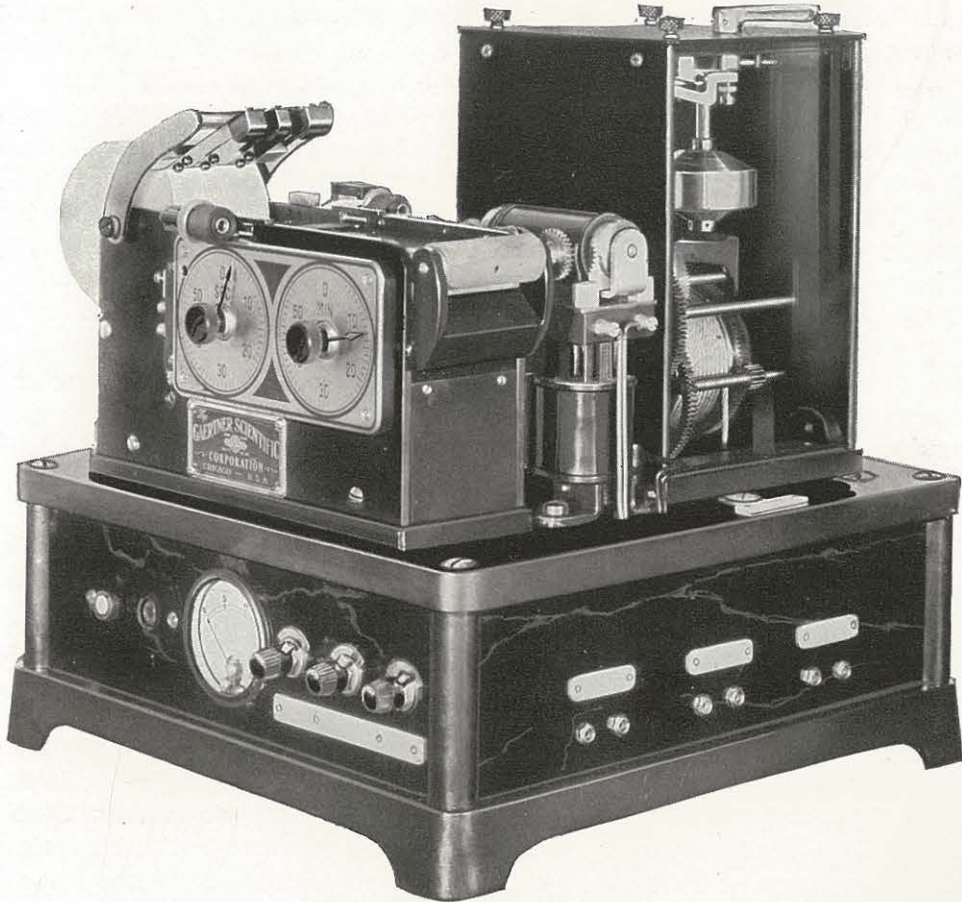
The Chronographs listed above are also furnished equipped with a Warren Telechron Electric Motor to take the place of the clock. Where accurately controlled A.C. current is available, this method of drive is desirable as the cost of the chronograph is considerably less and the Electric Motor requires very much less attention and care than the clock.

A350a Drum Chronograph with One Recording Pen. Similar in every respect to A350 but with Warren Telechron Motor.....\$310.00

A352a Drum Chronograph with Two Recording Pens. Similar in every respect to A352 but with Warren Telechron Motor..... 350.00

A354a Drum Chronograph with Three Recording Pens. Similar in every respect to A354 but with Warren Telechron Motor..... 390.00

PRINTING CHRONOGRAPH



A380

A380 Printing Chronograph—Design 1929. The instrument is, in general design, similar to the Printing Chronograph constructed by the late Professor Hough of the Dearborn Observatory of Northwestern University, but differs principally in respect to the control which is of our own design and assures an accuracy of 1/100th of a second.

The principal components of the Chronograph consist of a powerful Driving Clock, the Printing and Controlling Mechanism, and the necessary operating Relays, together with accessories, such as switches, contact keys, etc. The clock with printing mechanism and controlling device is mounted on a heavy bakelite plate which forms the top of a case in which the relays, fuse blocks, and other accessories are mounted. Access to the case can be obtained through a removable panel.

DRIVING CLOCK—The Clock is of improved design, dust-proof enclosed in a heavy brass case with plate glass sides, removable to allow access to the gearing. The governor is of friction-type with the pendulum arms made of "invar." In general the construction of the governor is of the same type as used by us for over thirty years on Astronomical Driving Clocks and Chronographs, and permits ex-

tremely close regulation. The gears are accurately cut and mounted. The pinions and shafts are in one piece, hardened and polished. The larger shafts run in high grade ball bearings, assuring a minimum and constant friction. With a drop of the driving weights of 80 inches, the clock will run two hours. A set of maintaining gears is provided only when specially requested.

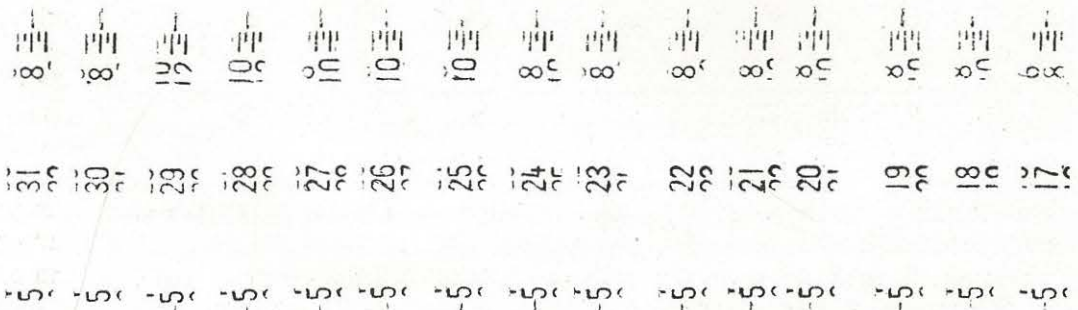
PRINTING MECHANISM AND CONTROL—A shaft extending from the Driving Clock, running at a speed of one revolution per second, carries a ratchet wheel with 100 teeth, in which engages a pawl attached to a shaft coaxial with the clock shaft on which is mounted the first (.01 seconds) type wheel. The pawl is disengaged from the ratchet wheel through the operation of a small electromagnet (control magnet) without interfering with the speed of the driving clock. The method of control is as follows:

The clock is adjusted to run sufficiently fast to gain about one second in six minutes. The control magnet, which is connected through a relay in the chronograph with the regulator clock or chronometer, receives by means of a special contact device, an impulse only when the chronograph driving clock has gained .01 seconds; then the pawl is disengaged and the 1/100 seconds type wheel retarded for .01 seconds.

In order to have the control operate with a Regulator Clock or Chronometer which does not make a contact every second, a device is provided which allows an impulse to the control magnet only every fourth second.

The type wheels are independently mounted on coaxial shafts running in ball bearings, and are actuated through the driving clock. The first wheel, for printing hundredths of seconds, has a continuous rotation as given by the pawl engaging in the 100-tooth ratchet wheel on the clock shaft. The wheel has, adjacent to the type, a graduated scale with 200 raised lines, each being equivalent to 0.005 seconds. The next type wheel, for printing seconds, is actuated through a cam attached to the first wheel. The third type wheel, for printing minutes, is also actuated through a cam attached to the second wheel shaft. The exact printing positions of the second and minute wheels are shown on two clock dials.

The three printing hammers are attached to stiff springs and mounted on the rotating armature of a strong electromagnet. They strike the paper tape stretched over the type wheels a sharp blow and rebound instantly without any effect on the rotation of the type wheels. The paper feed mechanism consists of two rollers actuated through a ratchet wheel, which is operated by an electro magnet. Immediately after printing, the paper is shifted and ready for the next print. The paper is



Sample Record of Chronograph A380

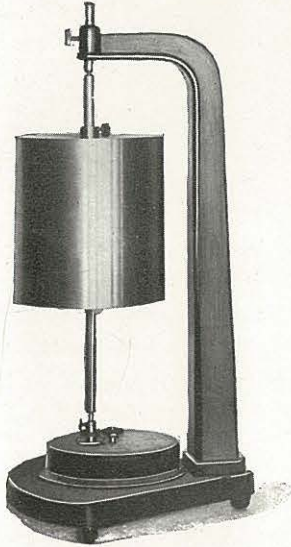
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of good white grade, 50mm by about 50 meters long. The prints are made through a silk ink ribbon, which is shifted automatically after every print. The prints are immediately visible and accessible for notation.

RELAYS—The Relays, mounted in the case below, are specially designed to give a quick “make” or “break” contact with minimum lag, and are easily accessible through the removable panel. One panel of the case is fitted with a plug to which the supply of 12 volts D.C. is connected. A voltmeter, the main switch, and three switches for check, setting, and control, are mounted on the second panel, and the third panel carries six terminals, two of these for connecting the regulator clock, the second two for the printing key, and the last two for the spacing key; the last four terminals can be connected to contact keys at any desired distance. On top of the bakelite base, above these terminals, two contact keys are mounted for direct operation of the printing and spacing. An independent action for spacing is required when an extra wide space is wanted between two records.

Price on application.

RECORDING DRUMS AND ACCESSORIES



L5003



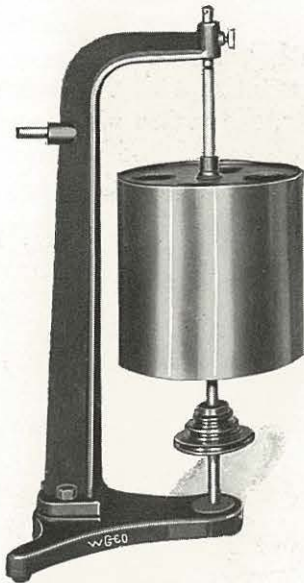
L5004

L5003 Recording Drum. The drum has a diameter of 15cm and a length of 15cm. It is mounted on a shaft on which it can be shifted and clamped in place. The shaft and the drum are easily removable from the frame. The clock is a well-made, strong, eight-day clock. Three different speeds of 6, 12, and 24 hours can be obtained by means of change gears. The drum may be used vertically or horizontally.....\$85.00

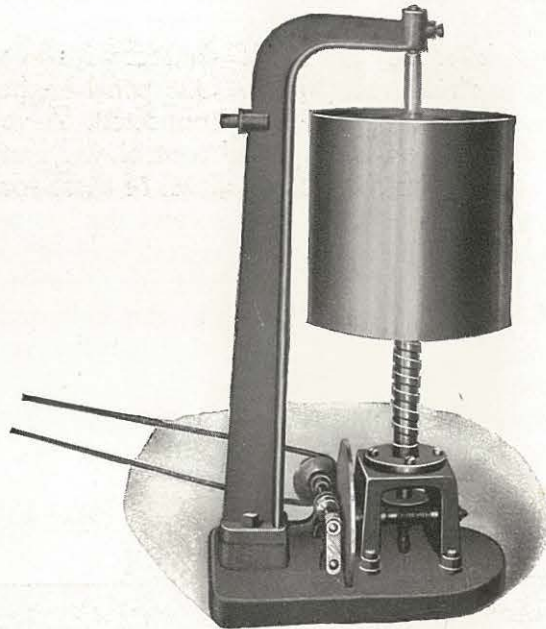
L5004 Recording Drum. The drum is similar to L5003, being 15cm in diameter and 15cm in length, and can be quickly removed from the vertical shaft. The drum is intended for vertical use only and has the advantage of being accessible all around. It is intended for one speed only, which may be 6, 12, 24, or 48 hours per revolution, as requested.....\$70.00

L5007 Recording Drum. The drum is 15cm in diameter and 15cm in length and is mounted on a shaft on which it can be shifted and clamped in place. The shaft is provided with a three-step cone pulley intended for a 3/16" round belt. The

drum can be used vertically or horizontally and may be driven by a small electric motor or any other source..... \$45.00

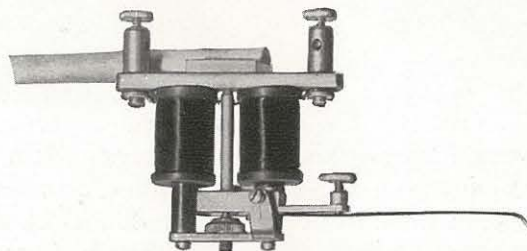


L5007



L5009

L5009 Recording Drum. The drum is 15cm in diameter and 15cm in length, mounted on a shaft which is fitted with a one-half inch pitch screw thread on which the drum shifts while revolving, so that continuous tracings up to 6 meters in length can be obtained. The apparatus may be used vertically or horizontally. When the drum reaches the end of the shaft it is automatically disengaged. Rotation is supplied by means of a friction disc driven by a pulley intended for a 3/16" round belt. The speed can be regulated by adjusting the friction drive.....\$100.00

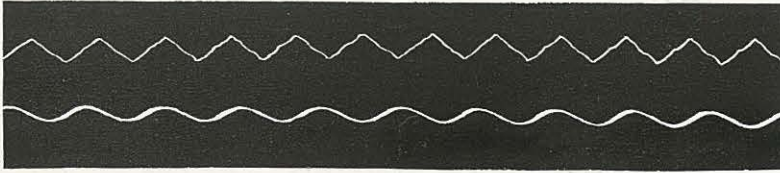


L5020

L5020 Electric Time Marker. This instrument can be used with the Recording Drums for tracings on smoked paper. The sensitive stylus is operated by an electromagnet, and will vibrate synchronously with an electric tuning fork when connected in series with the fork and a six volt source of current. The amplitude and the natural period of vibration of the instrument are adjustable within limits; it is recommended for frequencies up to 100 v.p.s. The marker will operate from any contact regulating apparatus, such as the Chronometers, Regulator Clocks, Seconds Pendulum or the Metronome L1016. This instrument also operates very satisfac-

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torily from the 4 volt output of a small step-down Transformer to give one vibration for each half cycle. This arrangement will be found very convenient where the A.C. cycles are sufficiently accurate for the requirements.

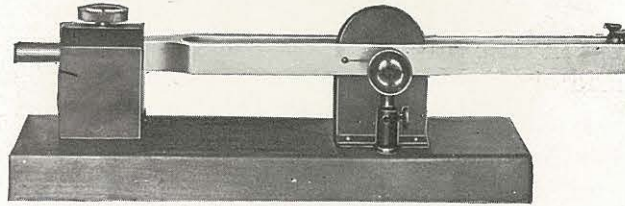


The illustration shows the curve (upper) made by the marker with E1460 Transformer compared with the curve (lower) produced by the tuning fork of 100 v.p.s. which is commonly used for marking time on our chronographs.

The supporting shank is 10mm in diameter and 150mm long. Resistance 1 ohm..... \$17.50



E1460



L3003

E1460 Transformer, Step-down. Will operate the Electric Time Marker L5020. The transformer is encased in an enameled steel case and immersed in an insulating compound. Specifications; primary voltage—110 volt, 60 cycle, A.C.; secondary voltage—2 to 28 volts; capacity—150 watts; dimensions 6"x5"x4½".

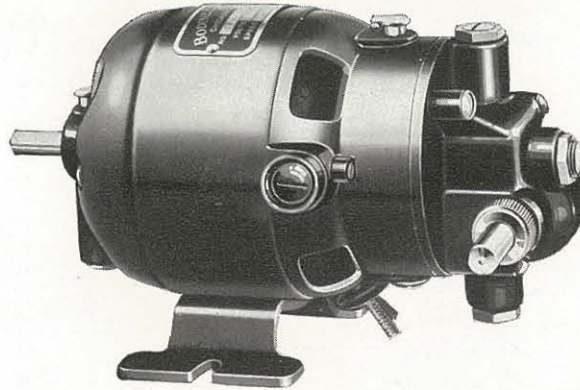
Transformer with 8 feet of flexible cord and plug and with five pairs of lead wires with brass terminals..... \$ 7.50

L3003 Electrically Driven Tuning Fork—100 v.p.s. (Can also be furnished for 200 v.p.s) Will operate the Electric Time Marker L5020 when connected in series. Equipped with platinum contact points and a stylus on one prong. Fork and driving magnet complete, mounted on a rigid iron base..... 35.00

L5022 Smoking Apparatus. Consists of a substantial base upon which are mounted a pair of Y's for receiving the shaft of the drum and supporting it in a horizontal position, and in which the drum may be rotated during smoking. For use with L5003, L5004 and L5007..... 8.50

Electric Motors with Speed Reducers. Very satisfactory for driving recording drums and for many other applications that require a reliable slow speed drive. Series wound, intermittent service motors which will operate on either 110 volts A.C. or 110 volts D.C. These motors are of the finest construction with high quality features such as dynamically balanced armatures, ground commutators, special non-freeze bearings, and silk insulated wire in the armature windings. The compact reduction gears are built into the motor housing, and are enclosed and well lubri-

cated. Where the recording drums are equipped with cone pulleys, the motors, rheostat, and pulleys listed here offer a choice of drum speeds from about 1 r.p.m. to 120 r.p.m. Power can also be taken directly from the armature shaft if desired. Armature speed under load, 5000 r.p.m.



E1848

E1848 Electric Motor with Speed Reducer. Drive shaft speed 4.5 R.P.M. under load; 1/50 H.P., 0.4 Ampere. Diameter of shaft 5/16". Without pulley \$18.00

E1850 Electric Motor with Speed Reducer. Drive shaft speed 35 R.P.M. under load; 1/50 H.P., 0.4 Ampere. Diameter of shaft 5/16". Without pulley 16.60

E1774 Rheostat. For use with above motors to regulate the speed. Substantially constructed, wound with oxidized wire of negligible temperature coefficient of resistance. Sliding contact adjustment 12 inches long. Resistance 357 ohms. Capacity 1.1 ampere..... 6.00

Pulleys, to fit the reduced speed drive shaft of the Motors E1848 and E1850. with groove for 3/16" belt. (We can furnish other size pulleys or countershafts upon request.)

E1852a Pulley, 1" in diameter—steel..... \$.50

E1852b Pulley, 2" in diameter—brass..... 1.00

E1852c Pulley, 3" in diameter—brass..... 1.25

E1852d Pulley, 4" in diameter—brass..... 1.50

E1853 Belt—3/16" round belting to fit the Motors and Recording Drums listed above. Per foot..... .12

E1854 Countershaft. Very desirable as a speed reducer or speed accelerator. Groove pulleys for 3/16" round belt. Six pulley diameters—6", 4", 2 1/2", 2", 1 1/2" and 1"..... 7.50

Note: We can also furnish the Motors as listed above with other ratios of speed reduction, or Motors to operate from 12 volts D.C. If those who have special needs for which the Drums and accessories listed are not adequate will write us and state their requirements, we will be glad to be of service in solving their problems.

CHRONOGRAPHS AND ACCESSORIES

RECORDING PAPERS

Coated Recording Paper. This type of recording paper is most universally used with the Chronographs. It is desirable because very little pen pressure is necessary to produce a distinct record and therefore little friction is encountered. A colored paper, which may be red or blue or black, is covered with a white, waxlike coating. A very light contact of the steel stylus removes this coating, revealing the paper beneath, and plainly marking the path. The coating is not easily removed by rubbing or handling.

L1003 Roll of Coated Recording Paper, 28mm wide, 120 meters (400 feet) long. Used with Tape Chronographs A370, A371, A372, A373, A376, A377, A378, A379, A390, A392, and A394. Per roll.....\$.80

L1003a Roll of Coated Recording Paper. 52mm wide, 90 meters (300 feet) long. Used with Tape Chronographs A374, A375, A381 and A382. Per roll90

A362 Coated Recording Paper; in sheets 10"x20" (25cm x 50cm). Used with Drum Chronographs A350, A352, A354, A350a, A352a and A354a. Per hundred sheets..... 3.50

L5006 Coated Recording Paper; in sheets 6"x20" (15cm x 50cm). For use with Recording Drums. Per hundred sheets 2.50

Metallic Recording Paper. For those who prefer it we can furnish metallic recording paper for use with the Chronographs. Used with the stylus listed below, this paper receives the record as a black line upon its white surface. The lines are fine and smooth, permitting accurate measurements, and the process is clean because there is no coating material given off. However, this paper requires more pen pressure than coated paper.

L1004 Roll of Metallic Recording Paper, 28mm wide, about 60 meters (200 feet) long. Each.....\$.40

L1004a Roll of Metallic Recording Paper, 52mm wide, about 60 meters (200 feet) long. Each..... .75

A363 Metallic Recording Paper for Drum Chronographs. Sheets 10"x20". Per hundred sheets..... 3.50

A363a Spring Stylus for use with Metallic Recording Paper. Attaches to our regular recording pens. The writing tip of special alloy is designed to give a smooth, clean line with the smallest friction possible. Each..... 1.00

A363b Tuning Fork Stylus with special writing tip for use with metallic recording paper 1.50

White Bond Recording Paper. A high quality bond paper for use with ink pens. Ink recording practically eliminates friction, and is suitable for slow paper speeds.

L1007 Roll of White Bond Recording Paper, 28mm wide and about 100 meters (330 feet) long. Each.....\$.80

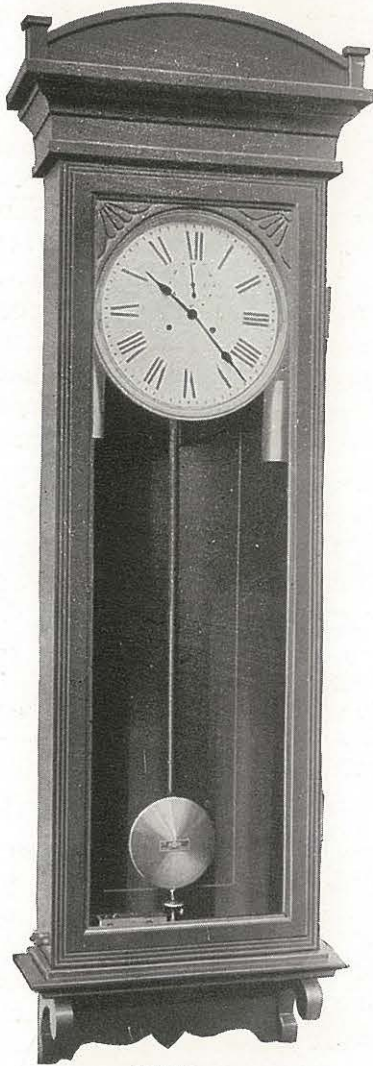
L1007a Roll of White Bond Recording Paper, 52mm wide and about 100 meters (330 feet) long. Each..... .90

A364 White Bond Recording Paper for Drum Chronographs. Sheets 10"x20". Per hundred sheets..... 1.25

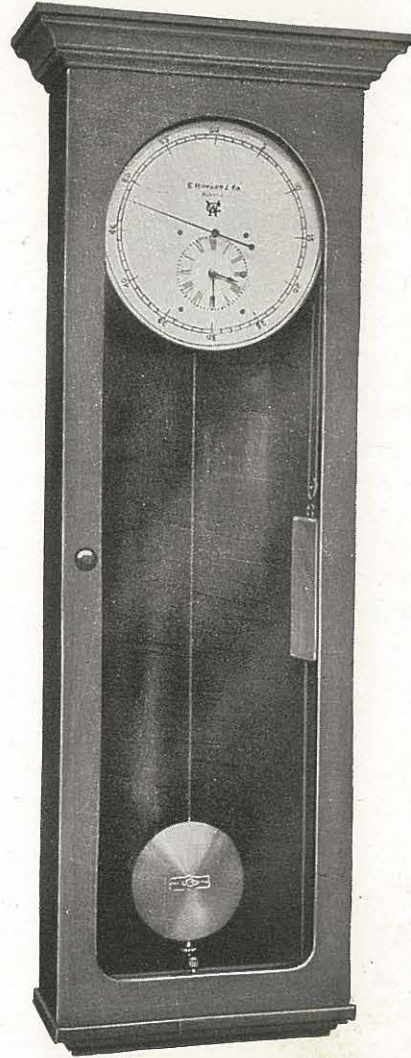
L5006a White Bond Recording Paper for Recording Drums. Sheets 6"x20" (15cm x 50cm). Per hundred sheets 1.00

L1008 Pen for Ink Records; attaches to regular stylus on Chronographs. Not recommended for speeds over 2cm per second	1.25
L1009 Special Recording Ink. Will not evaporate even when exposed several days, and will not fade. In 1/4 oz. bottle75
L5015 Glazed Recording Paper. To be used on the Recording Drums for obtaining smoked records. In white sheets 15cm x 50cm. Per hundred sheets	2.00

REGULATOR CLOCKS AND CHRONOMETERS



L1012



L1013

L1012 Regulator Clock. An 8-day weight-driven clock with a good reliable movement. The gears are carefully cut and machined from hard rolled clock brass. The pinions and arbors are of steel, tempered and highly polished. The dial is 12" in diameter with large Roman numerals. The pendulum beats full seconds; the bar is made of well seasoned wood with a heavy bob, 6" in diameter.

CHRONOGRAPHS AND ACCESSORIES

A platinum point at the end of the bar, sweeps over a mercury contact attached to the bottom of the clock case. The mercury contact is provided with all the necessary adjustments. It is also equipped with a small cup in which the spilled mercury collects. The electrical connections are brought to the binding posts on the outside of the case. A high resistance coil is provided in order to eliminate the sparking at the contact points, and is attached inside of the clock case.

The movement is mounted in a beautiful mahogany finished case, 60 inches high and 20 inches wide, with glass paneled door. The clock will keep accurate time to within about thirty seconds per month..... **\$87.50**

L1013 Regulator Clock. This clock is intended for accurate service in Physical Laboratories, Astronomical Observatories, etc.

The 8-day weight-driven movement is well made throughout and is mounted and reinforced on a heavy steel plate. The wheels are carefully and accurately cut from hard rolled clock brass; the pinions and arbors are cut from solid steel rod, tempered and highly polished. The movement plates are specially heavy, affording good bearings for all pivots. The escapement is of the Graham Dead Beat type. The movement is made by the Howard Clock Company according to our specifications.

The dial is 13 inches in diameter, enameled on zinc with all the divisions accurately spaced. The hands are neatly made of blued steel and fitted with turned brass bushings. The hour and the minute hands are eccentric, while the large **SWEEP SECOND HAND** is concentric and can be seen from considerable distance, especially desirable for astronomical use.

The pendulum beats full seconds. The rod is made of "invar" steel which has a coefficient of thermal expansion of .0000009 per unit length per degree Centigrade. The body of the pendulum consists of a heavy lens-shaped brass shell, 8" in diameter, lead filled. A platinum point is attached to the end of the rod.

The improved mercury contact assures short and accurate signals and is provided with all the necessary adjustments. The adjustments for equalizing the two successive time intervals, for raising or lowering of the mercury cup, and for raising or lowering the mercury meniscus, can be readily effected from the outside of the clock case. It is also equipped with a small cup in which spilled mercury collects. The electrical connections are independent of the movement and brought to the binding posts on the outside of the case. A high resistance coil is provided in order to eliminate the sparking at the contact points, and is attached inside of the clock case.

The case is substantially built of well seasoned birch, mahogany finished, 60 inches high, 17 inches wide and 7 inches deep. It is fitted with plate glass paneled door with lock. The clock will keep accurate time to within about 6 to 8 seconds per month..... **\$280.00**

L1013a Regulator Clock. The same as L1013 except with a magnetic contact of our own design, which has given excellent satisfaction in practice. The apparatus is at the lower end of the pendulum, easily accessible, and provided with the necessary adjustments for regulating the length of contact and for equalizing the intervals. It can be furnished either as a "make" contact or as a "break" contact. Equipped with platinum contact points. **310.00**

L1013b Regulator Clock. The same as L1013 except with mechanical break contact. A jewel contact point near the top of the pendulum moves

a light and delicately balanced lever which opens the platinum contact points at the end of each complete period of the pendulum with a minimum of effect upon the pendulum..... 320.00

Note: The Regulator Contacts described above are not intended for use across potentials of more than three or four volts. Circuits with higher voltages can be readily controlled by using in connection with the clock, a relay such as is listed on page 21.

We are prepared to quote on a **photoelectric contact attachment**, using either an alkali-hydride cell or a selenium cell. The great advantage of these is that they can be adapted to any clock without attaching any parts to the pendulum or adding any new forces to the pendulum to change its period.

We can furnish Regulator Clocks of greater precision, with sidereal or mean time dials, of domestic or foreign make, and will be glad to send descriptions and prices on request.



L10140

L10140 Chronometer with Electric Contact. This Chronometer is fitted with a high-grade, eight-day clock movement with accurately cut gears and pinions of hardened polished steel. The gears are gold-plated and lacquered, 7 jewels, compensated balance wheel. The dials are 5" in diameter. The electric second contact is fitted to the second wheel shaft and gives a "make" contact which is adjustable for length. The clock is mounted in a heavy dust-proof brass case and fitted in a mahogany carrying case with lock and key. A high resistance coil is placed in the circuit to avoid sparking at the contact points.

This Chronometer is designed for use in connection with our Chronographs and is specially convenient when used in places where a regular Regulator Clock cannot be employed..... \$175.00

CHRONOGRAPHS AND ACCESSORIES

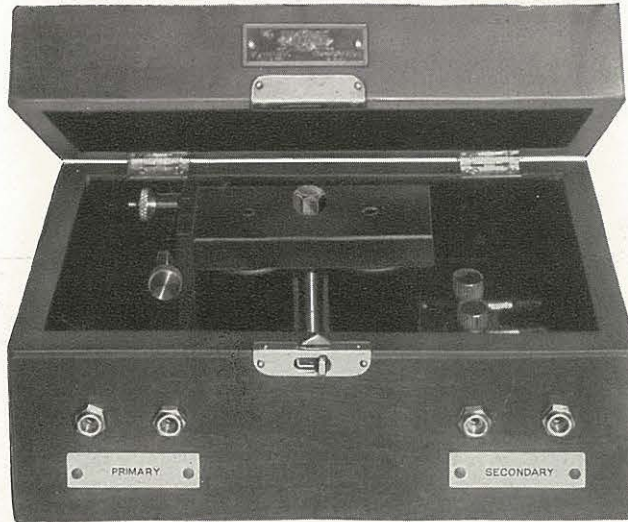
L10145 Waltham Chronometer with electric seconds contact. The Waltham 8-Day Lever Escapement Chronometer has established its absolute reliability under the most exacting tests and conditions. It has 15 jewels, is adjusted to changes in temperature and isochronism and given the polarity test.

The movement is enclosed in a dust and weather-proof case with screw back and bezel, and is suspended on gimbals which keep the movement always level and "dial up." There is a simple and yet safe locking device for holding the movement rigid, when the chronometer is carried. The strong and attractive brass-riveted, mahogany box has two covers or lids, the under one fitted with a glass which protects the movement and yet leaves the timepiece visible.

The dial has heavy plain figures and graduations, with heavy hands to correspond; winding indicator, showing on the dial the number of days the Chronometer has run.

The electric contact device is easily accessible for adjustment and a high resistance coil is built in to avoid sparking.

A special upholstered carrying case is supplied with each instrument.....\$225.00

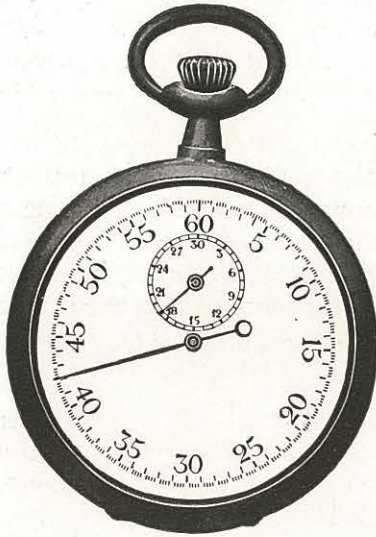


L10147

L10147 Relay. This instrument is intended for use in connection with our Regulator Clocks or Chronometers and will operate on primary with 2 to 3 volts. The secondary will carry voltages up to 12 volts. The instrument is carefully made and accurately adjustable for length of contact. Mounted in a substantial bakelite box **75.00**

L1009 Seconds Pendulum with Electric Contact. The pendulum takes the place of a Regulator Clock for recording time periods not exceeding an hour. The pendulum consists of a heavy cast-iron bob attached to a steel rod suspended from a hardened steel knife edge. The electric contact is similar to the one used on our Regulator Clocks, consisting of an adjustable mercury well mounted below the pendulum and a platinum point attached to the end of the pendulum rod. The pendulum and contact are mounted on a hard wood base..... **30.00**

STOP WATCHES



L10151

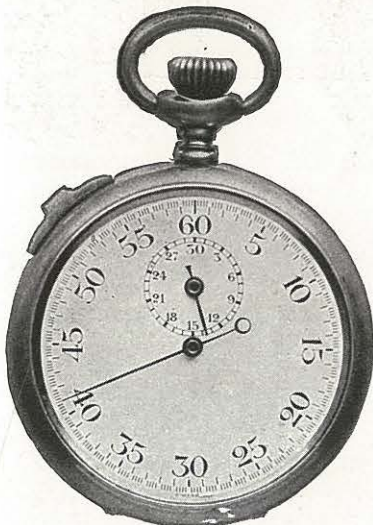


L10155

L10151 Stop Watch. For timing a single performance. The large hand registers $\frac{1}{5}$ seconds up to 60 seconds and the small hand registers minutes up to 30. In nickered case, stem wind..... \$14.50

L10152 Stop Watch. Like L10151 but registering tenths of seconds with 15 minutes register. Used where very accurate timing is required..... 15.50

L10155 Stop Watch—Minute Decimal. With side stop for timing interrupted performance. Registers hundredths of a minute up to 30 minutes. Stem wind, in nickered case..... 16.50



L10156



L10157

CHRONOGRAPHS AND ACCESSORIES

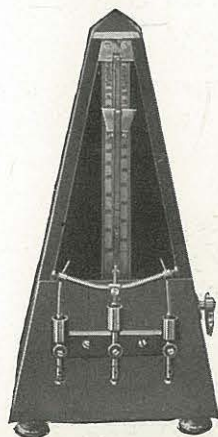
L10156 Stop Watch. For timing an interrupted performance. Registers $1/5$ seconds up to 30 minutes as L10151. A side slide permits stopping the timer at will and recording the time of the interrupted performance with exclusion of the time taken up by interruptions. The side slide also automatically locks the stem, a valuable safety feature which prevents errors. In nickeled case, stem wind..... **16.50**

L10157. Split-second Timer. Equipped with two sweep second hands. A push on the crown starts both hands, which move together until a reading is desired, when one hand may be stopped by means of a side pin. A second push on the pin brings the retarded hand together with the other. Registers $1/5$ seconds up to 30 minutes. Very convenient for timing an uninterrupted performance in which a series of readings are necessary, or for timing several performances simultaneously. Stem wind..... **35.00**

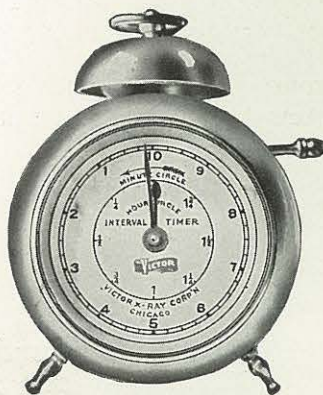
L10160 Chronometer. An instrument which serves the dual purpose of a regular pocket watch and a stop watch. It is equipped with regular hour, minute, and second hands, and with a stop watch second hand indicating $1/5$ seconds and a stop watch minute dial reading to 30 minutes.

This watch combines style and beauty with quality and accuracy. Fifteen jewel lever movement with compensating balance, in 14K rolled gold plate case, thin model, size 12..... **\$50.00**

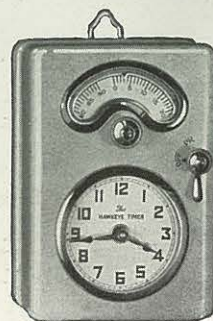
INTERVAL TIMERS



L1016



L1017



L1018

L1016 Metronome with Electrical Contacts. This is a high grade metronome, equipped with mercury cups and binding posts for electrically marking time. Used in connection with revolving drums and electric time marker. The pendulum can be regulated from 20 to 180 contacts per minute, and the length of contact can be varied by adjusting the dip in the mercury cups. This may be connected as a make or break circuit. Double periods are recorded by connecting one terminal to the center binding post and the other to the two outer binding posts. If whole periods are desired, connect to the center post and one of the outer ones..... **30.00**

L1017 Interval Timer. For measuring intervals in any period from 15 seconds to 2 hours. An alarm rings when the time is up. The clock case is nickel-plated and the clock can be hung on the wall.

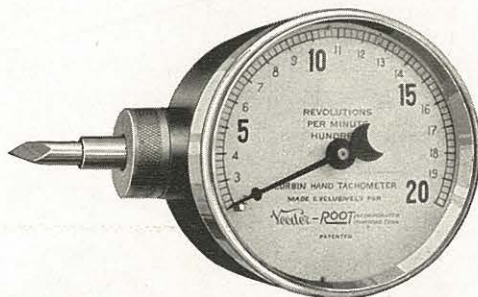
This timer is excellent for checking various manufacturing operations, laboratory processes and scientific tests..... \$ 4.50

L1018 Hawkeye Reminder. This Timing Clock is designed to serve for many purposes where accurate timing is required. The clock movement is of excellent workmanship and will keep exact time. The timing device can be set by a knob operated dial below the clock face to give an alarm within one minute up to ninety minutes, at the end of which time a bell is rung. The clock case is finished in gray enamel.

The Hawkeye Reminder will be found indispensable in Industrial and Educational Laboratories, for photographers, physicians, industrial plants, etc., where processes have to be accurately timed.....\$7.50



L1019



T3110

L1019 Eastman Timer. Specially designed for use in photography for accurately timing exposures or any other processes in the laboratories or manufacturing establishments.

The Eastman Timer has both minute and split-second hands which may be instantly re-set. The large and plainly marked dial is easily read in subdued light..\$5.00

T3110 Hand Tachometer. Indicates instantaneously the revolutions per minute of a shaft, fly wheel or other revolving part. The construction is on the same principle and design as the Corbin Speedometer, which is so well regarded for accuracy and dependability that it is used by over ninety-seven percent of municipal and state departments throughout the country.

The Tachometer utilizes the centrifugal principle, which affords a much more powerful, uniform action than obtainable with other principles such as magnetic, air flow, or air friction.

It is neither influenced by temperature changes nor climatic conditions, no matter how severe. The construction is exceedingly substantial, eliminating hair springs or other delicate parts, consequently making it absolutely safe in the hands of inexperienced users. Complete in mahogany finished, plush-lined case, with necessary accessories\$30.00

