C. H. WARNER.

AUTOMATIC TIMING DEVICE.

APPLICATION FILED MAR. 2, 1910.

1,053,685.

Patented Feb. 18, 1913.

6 SHEETS—SHEET 1.

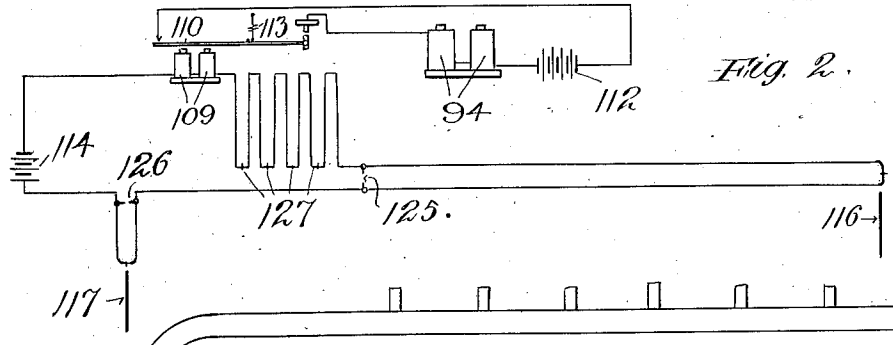

Fig. 2.

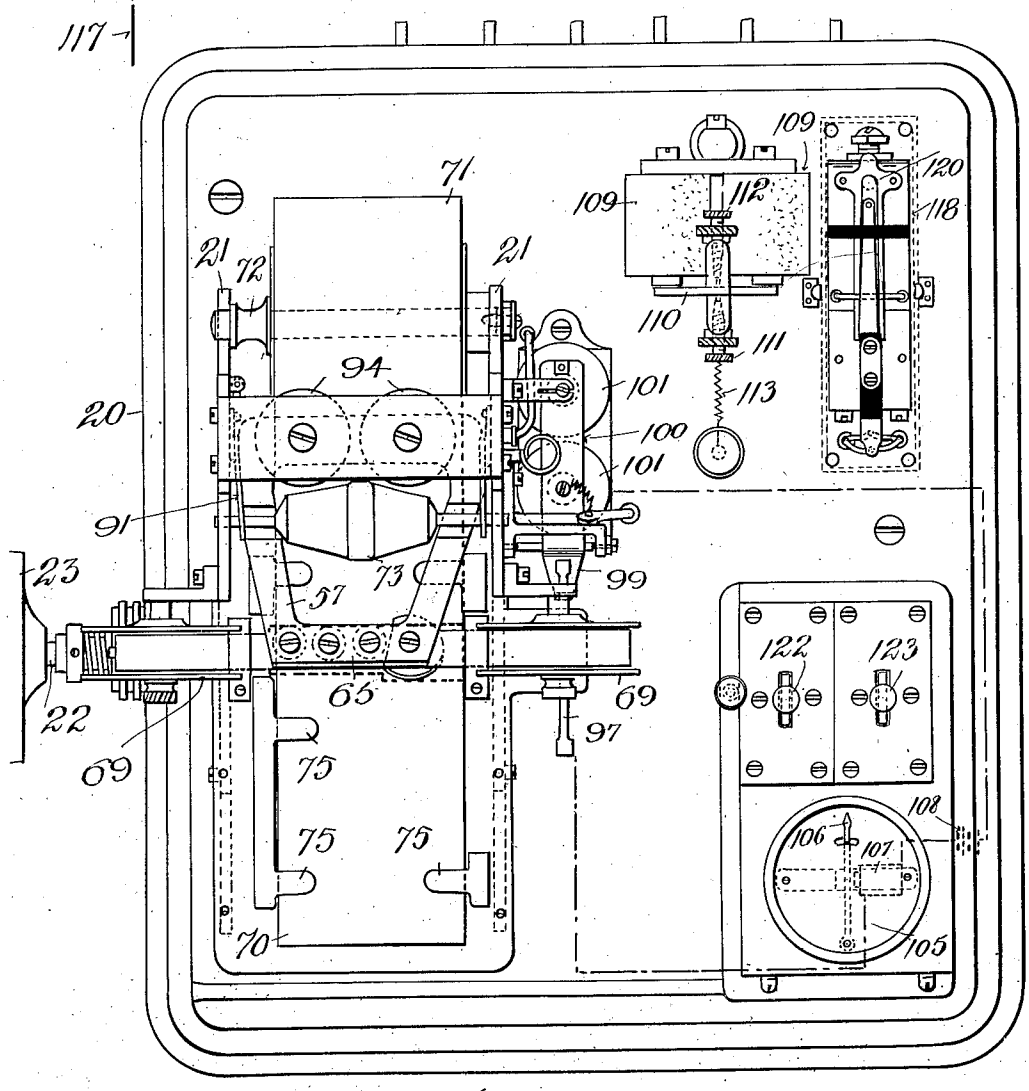

Fig. 1.

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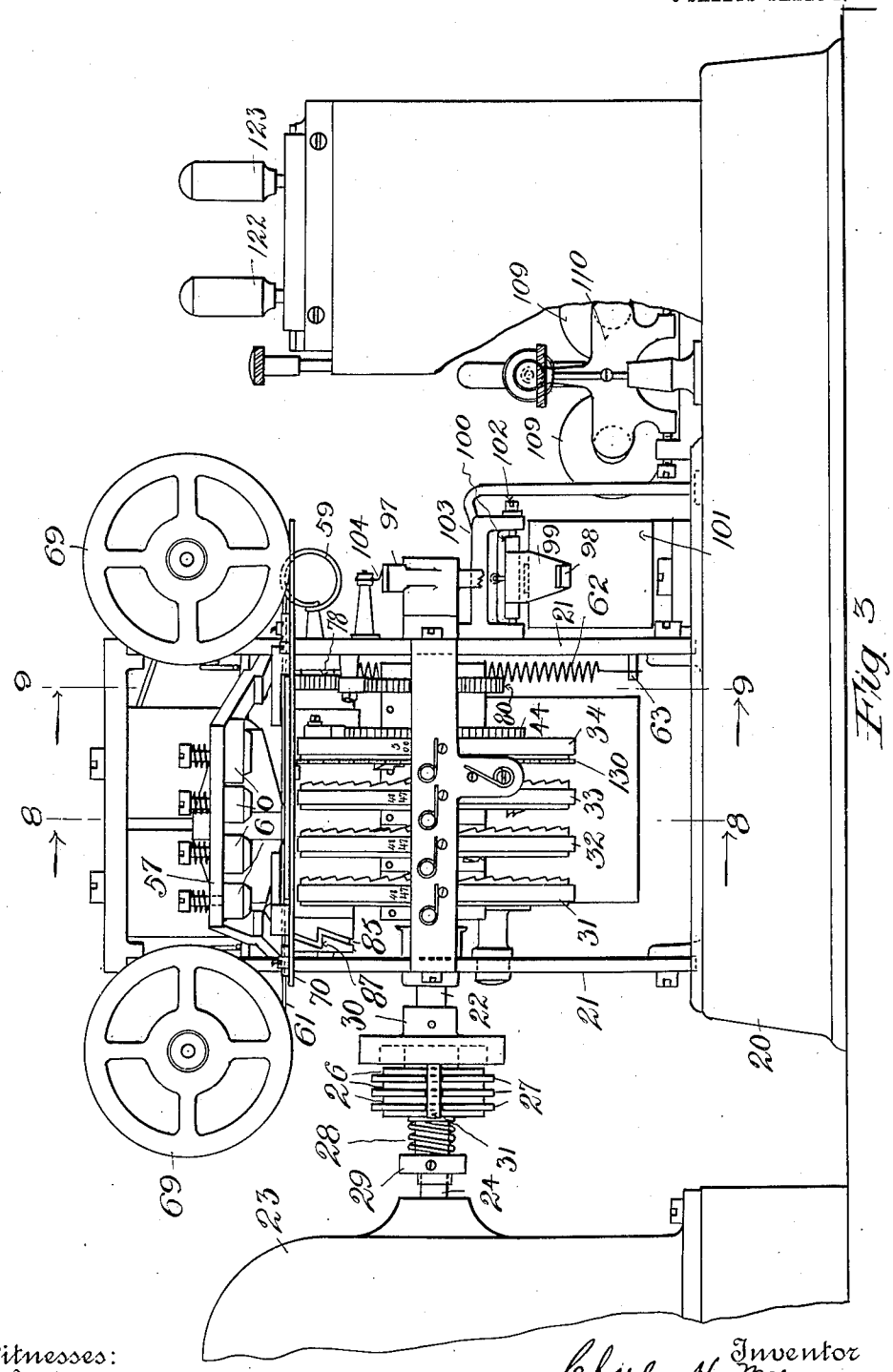

Fig 3

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6 SHEETS—SHEET 3.

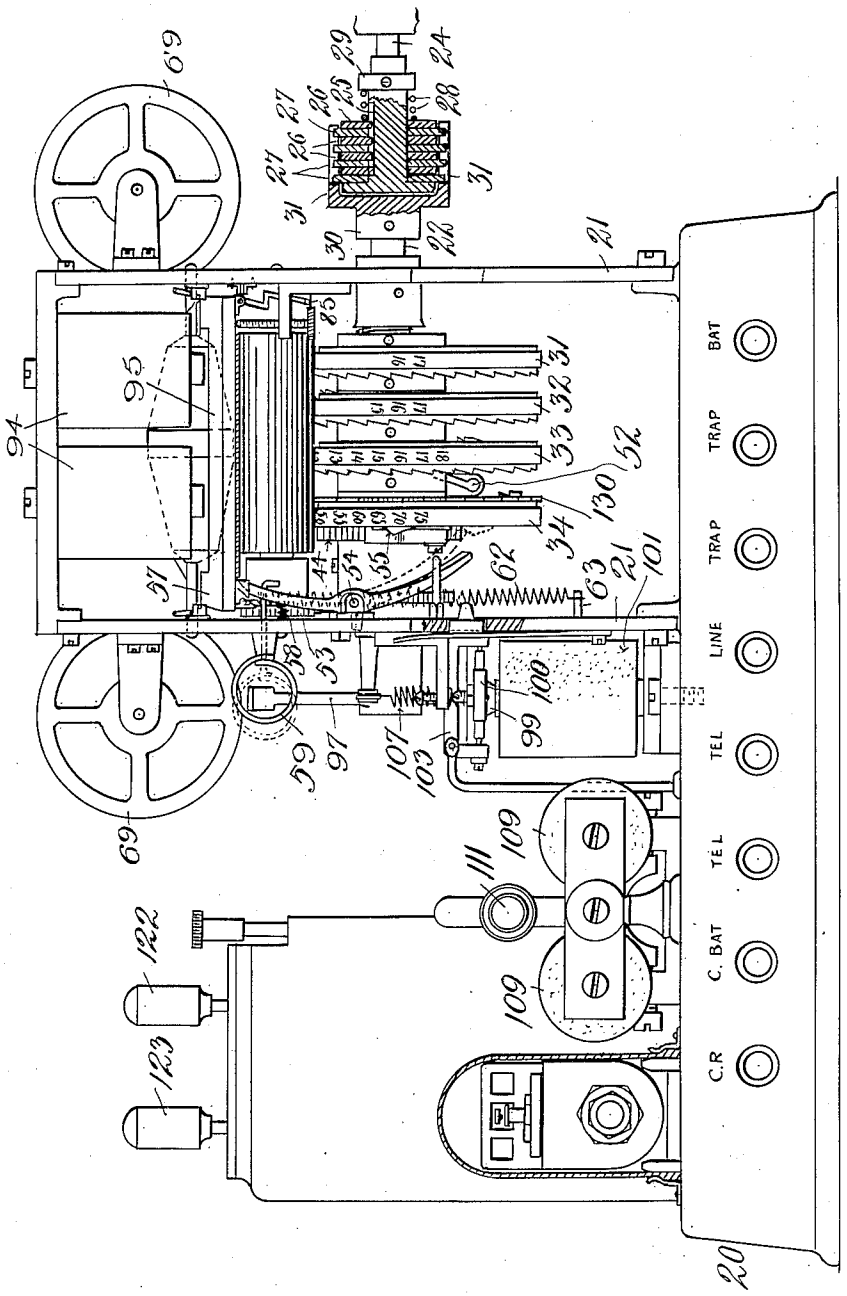

Fig. 4.

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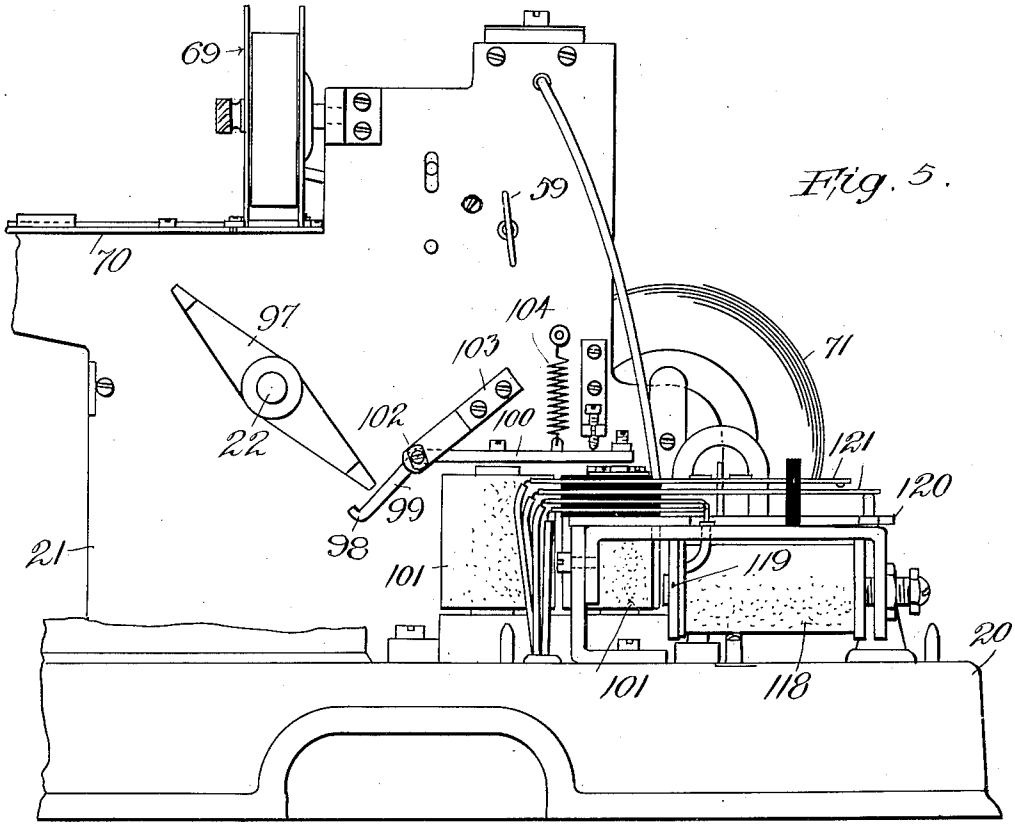


Fig. 5.

Fig. 7.

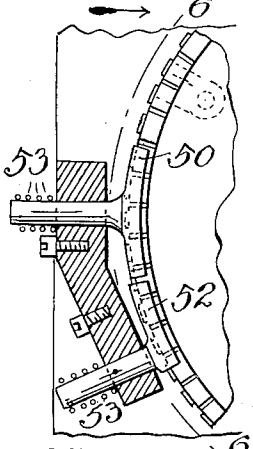
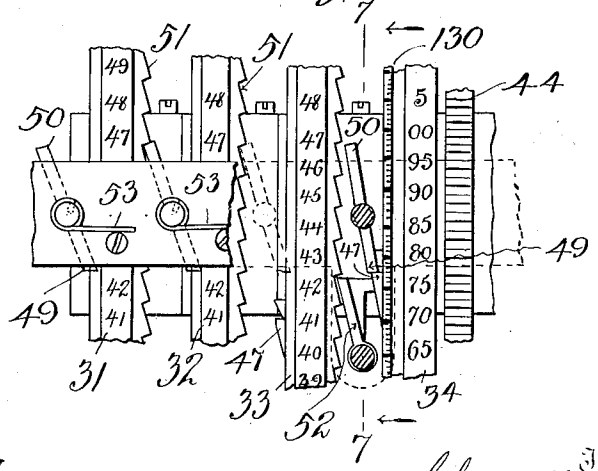


Fig. 6.



Witnesses:

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6 SHEETS—SHEET 5.

Fig. 8.

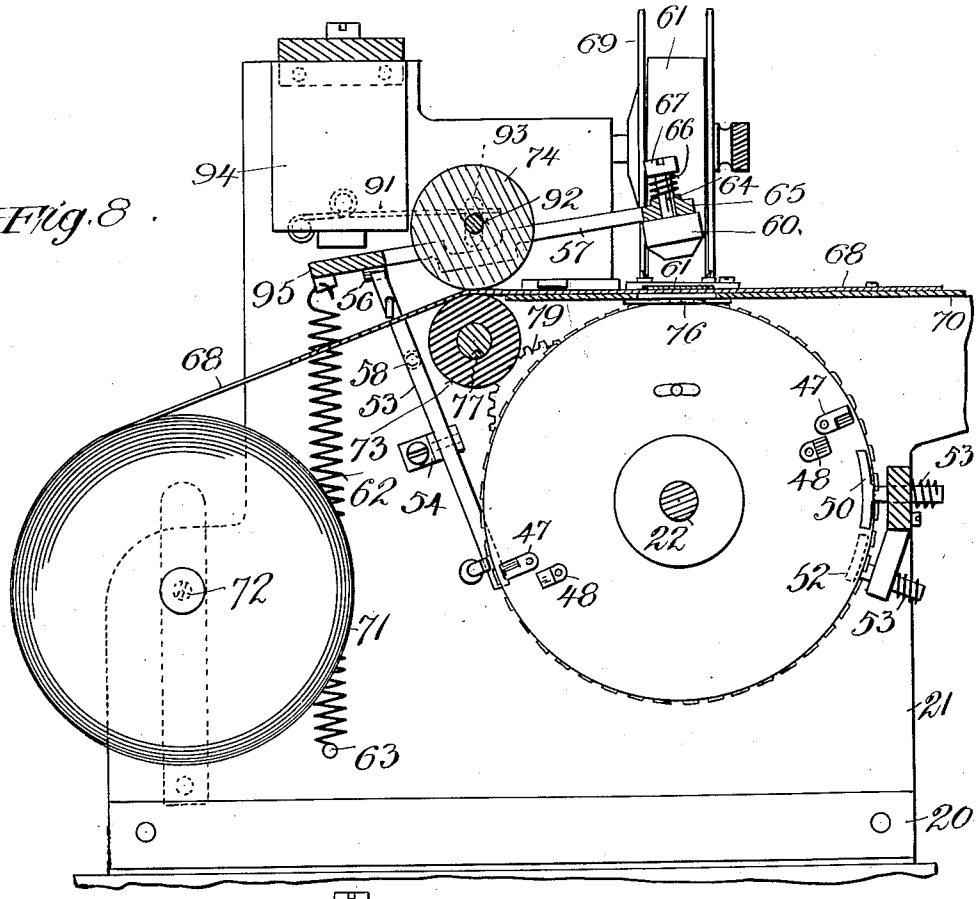
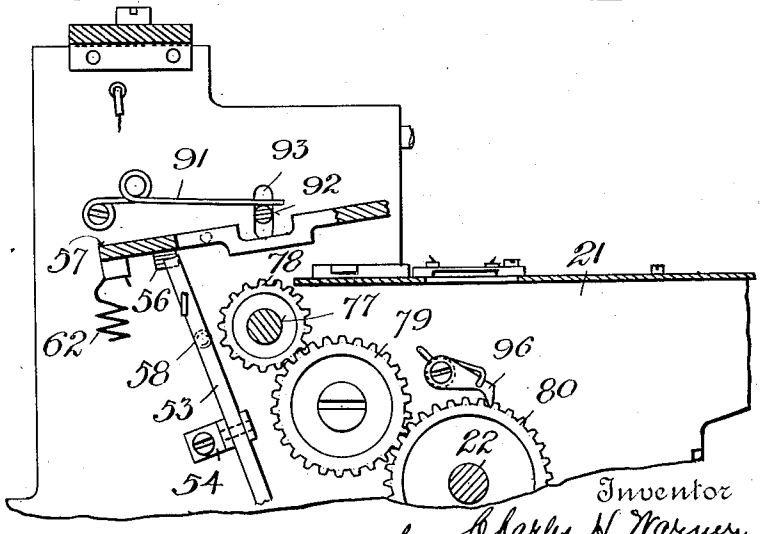


Fig. 9.



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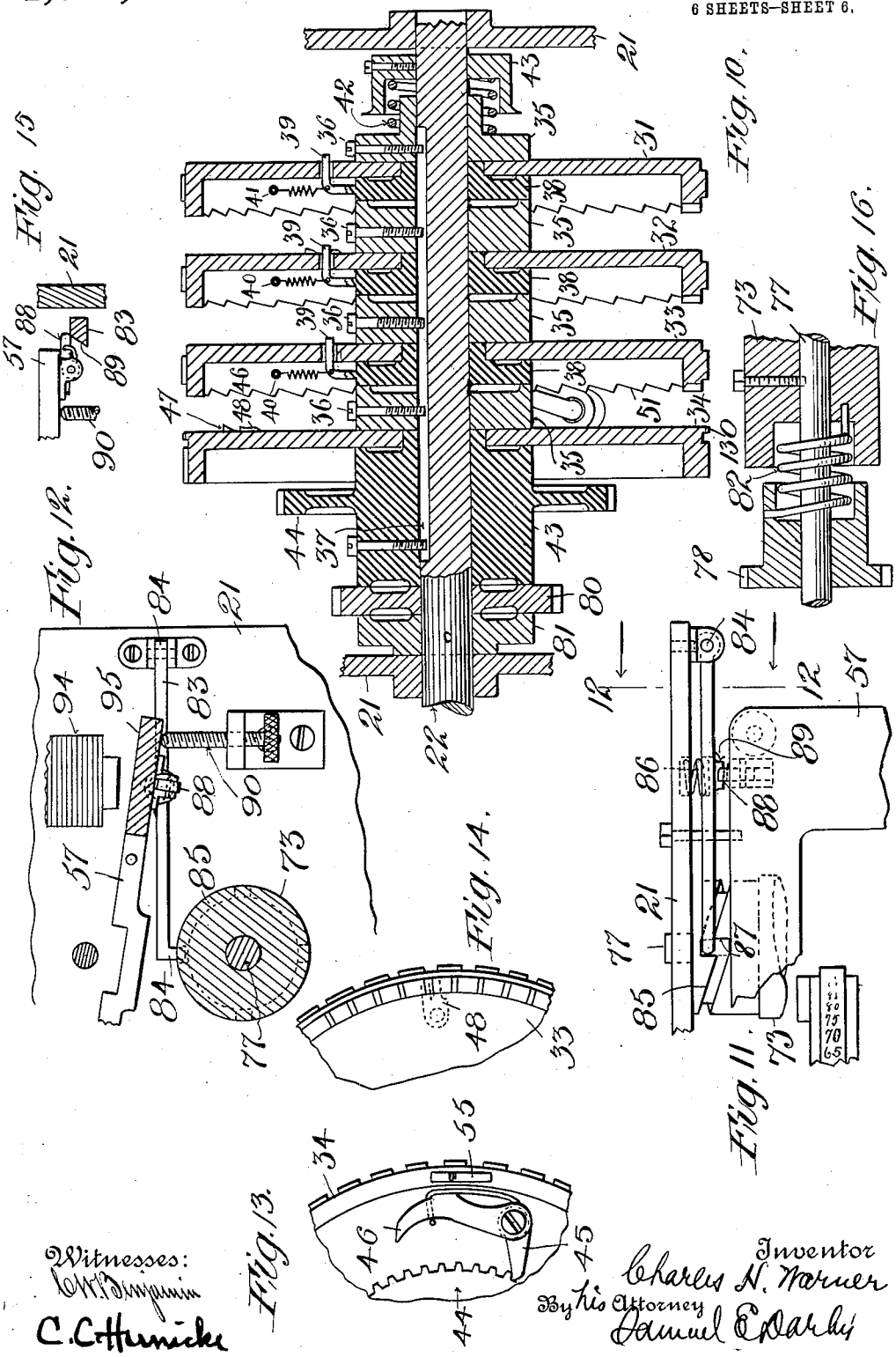
6 SHEETS—SHEET 6.



UNITED STATES PATENT OFFICE.

CHARLES H. WARNER, OF BELOIT, WISCONSIN, ASSIGNOR TO WARNER INSTRUMENT COMPANY, OF BELOIT, WISCONSIN, A CORPORATION OF ILLINOIS.

AUTOMATIC TIMING DEVICE.

1,053,685. Specification of Letters Patent. Patented Feb. 18, 1913.

Application filed March 2, 1910. Serial No. 546,920.

To all whom it may concern:

Be it known that I, CHARLES H. WARNER, a citizen of the United States, residing at Beloit, county of Rock, State of Wisconsin, have made a certain new and useful Invention in Automatic Timing Devices, of which the following is a specification.

This invention relates to automatic timing devices.

The object of the invention is to provide means which are simple, efficient and accurate in operation for automatically recording elapsed time in races.

Other objects of the invention will appear more fully hereinafter.

The invention consists substantially in the construction, combination, location and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

In the drawings, Figure 1 is a view in top plan of an apparatus embodying the principles of my invention. Fig. 2 is a diagram of the circuit connections. Fig. 3 is a view in front elevation of the construction shown in Fig. 1. Fig. 4 is a view in rear elevation, parts in vertical transverse, section. Fig. 5 is a view in side elevation looking toward the right-hand side of Fig. 1. Fig. 6, is a broken detail view in front elevation of the ratchet actuated recording wheels, parts broken out to show the relation and structure thereof, and parts in section on the line 6, 6, Fig. 7, looking in the direction of the arrows. Fig. 7, is a broken detail view in section on the line 7, 7, Fig. 6, looking in the direction of the arrows. Fig. 8, is a view in vertical section on the line 8, 8, Fig. 3, looking in the direction of the arrows, and parts broken off. Fig. 9, is a view in section on the line 9, 9, Fig. 3, looking in the direction of the arrows. Fig. 10, is a view in central longitudinal section of the recorder wheel carrying shaft, showing the manner of mounting the recorder wheels upon said shaft. Fig. 11, is a broken detail view in top plan of a portion of the printing hammer carrying plate. Fig. 12, is a broken detail view in section on the line 12, 12, Fig. 11, looking in the direction of the arrows. Figs. 13 and 14, are broken detail views showing portions of recording wheels in side elevation. Fig. 15 is a broken detail view in section showing a part of the ratchet operating mechanism. Fig. 16, is a broken detail view in section showing means for imparting rotative action to the paper feed roll.

The same part is designated by the same reference sign wherever it occurs throughout the several views.

The means heretofore employed for recording the elapsed time in automobile or other races have been more or less unsatisfactory and inefficient particularly with regard to the accuracy of the recording means employed and the further limitation that it has been impossible to record the elapsed time with a greater accuracy than that afforded by ordinary stop watches, and these are not ordinarily constructed to indicate anything shorter than one-fifth of a second. Moreover, in attempting to record the time of races by employing manually controlled stop watches or similar devices, the element of personal error enters into the operation, it being impossible to gage with absolute accuracy the exact instant of time when the race starts or is completed. In the case of races or movements involving very high speeds this element of personal error becomes a matter of material consequence, as does also the inability to record more accurately than one-fifth of a second. For instance with an automobile, locomotive, moving part of machinery, or the like, traveling at a high speed, say, for instance, fifty miles an hour, no greater accuracy of timing the operation is possible than within a range of about fourteen feet of movement of the automobile, locomotive or the like, even employing stop watches graduated to periods of time no greater than one-fifth part of a second, and even eliminating the element of personal error, which of itself is a factor to be considered.

It is among the special purposes of my present invention to provide means which are automatic in action and which are absolutely accurate in timing races or movements to the one-hundredth part of a second, or even less, if desired, and wherein the element of personal error is entirely eliminated.

In carrying out my invention I provide means set into operation at the instant the start of the race, machine or other movements, begins. I also embody means for

recording the elapsed time from the instant of commencement of the movement, race or the like to be recorded, to the instant of the completion of such race or movement, and with absolute accuracy to within the one-hundredth part of a second, or less, if desired. To this end, and in one method or practical application of the principles of my invention, as, for instance, the timing of an automobile race, I provide means arranged to be rendered effective at the start of the race, as for instance by the automobile completing an electric circuit at the instant it starts on the race, the completion of which circuit sets in operation mechanism for indicating or recording the exact instant of time said circuit was completed. Similarly, I propose to embody means for closing a circuit by the automobile itself at the instant it has completed the race, the closing of which circuit sets in operation means for indicating or recording the exact instant of time when said circuit was closed.

While I have referred to the use of the apparatus in connection with recording the elapsed time in an automobile race, I wish it to be distinctly understood that my invention, as defined in the claims, is not to be limited or restricted in this respect, as apparatus embodying the principles of my invention is capable of, designed and intended for other uses and purposes.

Referring to the accompanying drawings, and to the various views and reference signs appearing thereon, reference sign 20, designates a base upon which the various operating parts of the apparatus are mounted. A supplemental frame comprising side pieces 21 is mounted upon the base frame and in this supplemental frame are mounted the printing and recording mechanisms hereinafter to be described. Suitably journaled in the side pieces 21 of the supplemental frame, to rotate therein, is a shaft 22, adapted to be driven from any convenient source, such, for instance, as a motor indicated at 23, the shaft 24 of which is coupled to shaft 22, in any suitable or convenient manner permitting a slipping action if necessary, such, for instance, as a friction drive clutch.

In Figs. 3, and 4, I have shown a form of friction drive which I have found suitable for my purposes, wherein the motor shaft 24 is provided with a key way 25, in which engage disks 26, mounted on shaft 24, and by reason of the engagement thereof in the key way 25, said disks revolve with shaft 24. Interposed between adjacent disks 26, are friction disks 27, loose on shaft 24. The disks 26, 27, are held in frictional bearing contact with respect to each other in any convenient manner, as, for instance, by means of coiled spring 28, interposed between a collar 29, fixed to shaft 24, and the outermost of the disks 26. The outer end of shaft 22, carries a sleeve 30, having lug arms 31, arranged to engage in peripheral notches formed in the friction disks 27. In this manner the shafts 22, and 24, are frictionally coupled together.

Between the side pieces 21 of the supplemental frame on that portion of shaft 22, which extends between said side pieces, is mounted the registering or recording mechanism. This mechanism, in the particular structure shown, includes a series of wheels 31, 32, 33, 34. These wheels carry suitable type characters upon the peripheral surfaces thereof and are rotatively displaced in any suitable or convenient manner in the orderly operation of the apparatus, as will be more fully explained hereinafter. In practice, I prefer to rotatively displace these wheels through frictional drive connections. To this end I mount collar 35, upon shaft 22, to rotate therewith, but capable of sliding movement longitudinally thereof. A convenient way of accomplishing this is shown wherein studs or bolts 36, pass through the sleeves 35, and have their inner ends received in a key way or slot 37, see Fig. 10, formed longitudinally of shaft 22. The collars 35, are interposed between adjacent printing or recording wheels 31, 32, 33, 34. Instead of mounting the printing or recording wheels directly upon shaft 22, I prefer to mount these wheels loosely upon short hubs of collars 38, which, in turn, are loosely mounted upon shaft 22, as clearly shown, the lateral or face bearing of the wheels and collars against each other producing the necessary friction to drive and operate the printing or recording wheels. It is desirable that a rotative tension be imparted to the printing or recording wheels, tending to normally displace the same rotatively. To secure this result, I provide the collars 38, with projections or extensions 39, extending through slots or openings 40, formed in the printing or recording wheels, and I connect the printing or recording wheels yieldingly to said extensions, as, for instance, through springs 41. By this arrangement a constant rotative tension is imparted to the printing or recording wheels, so that the instant one of these wheels is released by the pawl and ratchet mechanism, presently to be described, it will immediately take up this rotative action for advancement one step, without depending upon the frictional drive therefor.

Inasmuch as the primary object of the present invention is to secure a record of time to within a very small fraction of a second, say the one-hundredth part of a second, I am enabled to accomplish this result by the arrangement above described, whereas if it were necessary to depend solely upon the frictional drive for these printing or recording wheels, the degree of absolute accuracy

attainable would be much less than the one-hundredth part of a second.

In order to secure an efficient frictional contact of the printing and recording wheels and their driving collars, I propose to apply a yielding pressure upon the assembled wheels and collars, tending to move the same endwise with respect to the shaft 22. This can be conveniently accomplished by interposing a spring 42, between a collar 43, secured to shaft 22, and the outermost collar 35. The tension of this spring pressing upon the outermost collar 35, tends to crowd or press the wheels and interposed disks flatwise against each other, thereby securing the desired degree of frictional drive.

I will now describe the pawl and ratchet mechanism for effecting the rotative displacement of the printing or recording wheels. In this connection I point out that the rotative displacement of these wheels is accomplished after the manner of ordinary odometer wheels, that is, at each rotation of one of the wheels a rotative step or displacement is imparted to the next adjacent wheel. The wheel which is designated by reference sign 34, I will designate the hundredths wheel, in the particular arrangement shown wherein I propose to secure accuracy to within the one-hundredth part of a second. Instead of this wheel 34, being driven by friction with the rotative impelling force exerted by a spring, as 41, I mount said wheel 34, upon the hub of a sleeve 43, mounted upon, and keyed to rotate with shaft 22, and which sleeve is provided with a ratchet gear 44. Carried by the adjacent face of gear 34, is a spring pressed dog 45, having a tail piece 46. The dog 45, engages in the ratchet teeth of wheel 44, thereby locking the printing or recording wheel 34, and the gear 44, so as to rotate therewith, so long as the pawl or dog 45, remains in mesh with the teeth of gear 44. With this arrangement it is obvious that wheel 34, revolves once at each revolution of shaft 22. Where the degree of accuracy is to be attained to within the one-hundredth part of a second, the gear 44 is provided with two hundred teeth, where the speed of rotation of said gear is once every two seconds. Of course, by driving this gear 44, at a speed of one revolution per second, the number of ratchet teeth therein may be correspondingly reduced. In the particular arrangement shown, however, it is designed to rotate shaft 22, and with it the ratchet gear 44, at the rate of one complete rotation every two seconds. My invention, however, is not to be limited or restricted in this connection.

At each complete rotation of gear 34, two steps of rotary movement are imparted to the next adjacent printing or recording wheel 33, that is, at each half revolution of printing wheel 34, one step of rotary advancement is imparted to the wheel 33. This may be accomplished in many specifically different ways. I have shown a simple arrangement for accomplishing the desired object, wherein I mount dogs 47, 48, upon the side of wheel 34, which is presented toward the next adjacent wheel 33. Where two steps of rotary displacement are to be imparted to the next adjacent printing wheel for each complete revolution of wheel 34, I employ two sets of dogs 47, 48, at points respectively diametrically opposite each other. The dog 47, coöperates with the tail 49, of a pivoted pawl, the toe 50, of which coöperates with a ratchet gear 51, formed on the side edge of the next adjacent printing wheel 33, see Fig. 6. Similarly, each dog 48, not shown in Fig. 6, coöperates with the tail of a similar pawl 52, which also coöperates with the ratchet 51. The dogs 47, 48, of each set are spaced slightly apart with reference to each other and to the direction of rotary movement of gear 34, one of these dogs, namely, dog 48, will engage its coöperating pawl 52, and operate the same in advance of the operation of the other pawl 50, by dog 47. These pawls 50, 52, are preferably spring actuated by springs 53, which exert their tension on said pawls to normally maintain the same in engaging relation with respect to the ratchet gear.

In order to secure the desired coöperative action, the spring acting on pawl 52, serves to normally maintain said pawl out of engaging relation with respect to ratchet 51, whereas the spring acting on pawl 50, operates as above described to normally maintain said pawl in engaging relation with respect to ratchet 51, and the engagement of dog 48, with pawl 52, occurring slightly in advance of the engagement of dog 47, with pawl 50, serves to rock pawl 52, against the action of its spring, and into position to engage a tooth of the ratchet 51. This relation is maintained until dog 47, engages and releases pawl 50, from engagement of the ratchet 51, the wheel 33, during such disengagement being retained against rotative displacement by the enforced engagement of pawl 52, with ratchet 51, under the influence of dog 48. During the disengagement of pawl 50, with ratchet 51, a very slight rotative advancement of wheel 33, is permitted, the parts being so proportioned as to permit this, this rotative movement being just sufficient to permit the toe of pawl 50, to just clear the edge of the ratchet tooth with which it previously had been in engagement. Further rotative movement imparted to wheel 34, will carry dog 48, out of engagement with pawl 52, whereupon the spring acting on said pawl throws it out of engaging relation with respect to the wheel 33. Thereupon a quick rotative movement is imparted to wheel 33, under the impelling

force of the spring 41. During this slight rotative movement of wheel 33, the driving wheel 34, is continuing its rotative movement so as to free the tail end 49, of pawl 50, from engagement with the dog 47, so that by the time the rotary step of wheel 33 is completed, the pawl 50, has been released, and its toe is in position to engage behind the next tooth of ratchet 51. This same construction and arrangement is employed for imparting step by step rotative movements to the succeeding wheels 32, 31, but in view of the foregoing description, specific description thereof, with reference to said wheels 32, 31, is unnecessary.

While I have shown and described a specific construction of ratchet drive gearing, I do not desire to be limited or restricted in the broad scope of my invention, as defined in the claims, to any specific structure of ratchet, or pawl, or other drive mechanism as it is obvious that many other specific structures might equally well answer the desired purpose.

I will designate the second printing wheel 33, as the seconds wheel, and inasmuch as it is necessary to impart very quick rotative movements to this wheel in the attainment of accuracy to the degree indicated, I have employed the double pawl and dog construction above described. While the same may be employed in driving wheel 32, which I will designate, for instance, the minute wheel, and also in driving wheel 31, from wheel 32, said wheel 31 being designated, for instance, the hour wheel, still in practice only one dog and pawl may be employed for releasing wheels 32, 31, as clearly indicated in Fig. 6.

In order to accurately register and record, for instance, the elapsed time of a race, of an automobile or other race, or in the use of the apparatus for other purposes, it is desirable that the initial or hundredth of a second wheel 34, be locked in zero position against rotative movement with shaft 22, so that at the instant the race or movement, the speed or elapsed time of which is to be recorded, commences, said wheel may be released so as to instantly take up coincident rotative movement with shaft 22. I have shown a simple arrangement for accomplishing this result, wherein I provide a lever 53ª, pivotally mounted intermediate its ends upon a bracket 54, secured on the inner face of one of the side pieces of the supplemental frame. One end of this lever is arranged to coöperate with the lug 55, see Fig. 4, on the outer face of wheel 34, to arrest the rotative movement of said wheel when the latter stands in zero position. The end of lever 53ª, which when lever 53ª is in position engages the lug 55, to arrest wheel 34, is also in position to engage the tail 46, of dog 45, thereby releasing dog 45, from engagement with the teeth of ratchet gear 44, and for this purpose the lug 55 is arranged on the face of gear 34, opposite the tail 46, of pawl 45, see Fig. 13. The other end of lever 53ª, coöperates with a lug 56, formed on the plate 57, which carries the printing hammer or hammers presently to be described. The lever 53, is acted upon by a spring 58, the tension of which is normally exerted upon said lever in a direction to maintain the end of the same out of engaging relation with respect to the lug 55, on wheel 34.

When it is desired to arrest the rotative movement of wheel 34, as, for instance, at the beginning of a race, the lever 53ª, is rocked against the action of spring 58, and into position to engage lug 55, and the tail 46, of pawl 45, thereby releasing the latter from ratchet gear 44, at the same time causing the other end of lever 53ª, to engage behind the lug or shoulder 56, on plate 57. When in this position, the wheel 34, continues its rotative movement until lug 55, engages the end of lever 53ª, and the dog 45 is released, whereupon wheel 34 is disconnected from its drive and is held by the stop arrangement described, in its zero position. While so held, the shaft 22, may continue to revolve, and the seconds, minutes and hour wheels may be rotatively displaced by hand until they, too, occupy zero position. This part of the apparatus is now ready for a record to be made of the instant of time when the race or other movement to be recorded commences. This commencement of the race controls means which effect an actuation of the printing hammers, presently to be described, thereby rocking plate 57, and hence withdrawing the shoulder 56, from engagement with lever 53ª, and, consequently, said lever rocks instantly out of engaging relation with respect to lug 55, and tail 46, of pawl 45, hence permitting wheel 34, to instantly take up its rotative movement with shaft 22. From this point on, the operation of the device continues in its ordinary manner, until the instant of the ending of the race, when another record is made of the indications afforded by the characters carried on the peripheral surfaces of wheels 34, 33, 32, 31, thereby giving the interval of elapsed time between the commencement and ending of the race. The lever 53ª, may be operated into set position in any suitable or convenient manner by hand or otherwise. I have shown a convenient arrangement, wherein the lever is engaged by a hand operated piece 59, see Fig. 4, by means of which said lever may be moved into the required position to effect the arrest of wheel 34 in its zero position. The hand operated piece 59, comprises a ring-shaped handle part and a stem with a hooked end arranged to extend through the casing, the hooked end engaging the lever 53ª.

The plate 57, constitutes what I shall call the yoke or frame for carrying the printing hammers 60. The side arms of this yoke or frame 57, are pivotally supported respectively to the side pieces 21 of the supplementary frame. On one side of the points of pivotal connection of said yoke or frame 57, is connected one end of a spring 62, the other end being connected to a fixed part of the supplementary frame, as indicated at 63, see Figs. 4, and 8, the tension of which spring is normally exerted to maintain the free ends of the yoke 57, carrying the printing hammers, in elevated or raised position, as clearly seen in Fig. 8. The printing hammers 60, are mounted in the front or free end of the yoke 57, and correspond in number to the number of printing wheels, employed, one hammer being provided for each wheel. Each hammer is provided with a stem 64, extending through an opening in the front bar 65, of yoke 57, and the spring 66, is interposed between the upper surface of bar 65, and the head 67, of the stem 64. These springs serve to hold the printing hammers 60, raised against the under side of the bar 65, and in such relation that when the yoke 57, is rocked downwardly to effect the printing operation, a hammer blow is delivered by the hammers 60, under the influence of the momentum of the hammers operating freely in the supporting bar 65, and after delivering their hammer blows, the springs 66, raise the hammers slightly above the record ribbon or record paper. The extent of rocking movement of the yoke 57, to cause the hammers to deliver their hammer blow for printing is limited so as to secure the delivery of the desired hammer blow of the hammers, as above explained. This limitation of the rocking movement of the yoke 57, will be explained hereinafter.

The bar 65, which carries the printing hammers, extends transversely across the space between the side pieces 21 of the supplementary frame, and the record strip 68, operates longitudinally through this space between said side pieces of the supplementary frame and over the printing wheels and between the same and the printing hammers 60. A ribbon 61, carried on spools 69, placed on opposite sides of the side pieces of the supplementary frame, extends transversely of the space between the side pieces of the supplementary frame beneath the printing hammers, and immediately over the record strip 68. This ribbon is indicated at 61. The record strip, and also the printing ribbon, may be held and guided at the printing point in any suitable or convenient manner, the printing record operating over a table 70, through a transverse slot, in which the printing rollers are exposed for the printing operation.

From the foregoing description it will be seen that the type characters on the printing wheels are not reversed, and the printing action is accomplished by the delivery of hammer blows from smooth surfaced hammers operating directly upon the ribbon, reproducing in printing the characters from the printing wheels upon the record strip. Consequently, the record is rendered immediately visible and can be read direct from the record strip. The record strip may be conveniently supplied, as for instance, from a roll 71, carried by a shaft 72, conveniently journaled in the side pieces 21 of the supplementary frame, preferably at the rear of the machine. From the roll, the strip is led forwardly between feeding rolls 73, and 74, thence on to the plate 70, between guides 75, which engage over the edges thereof, said strip passing over the transverse opening 76, in the plate 70, at the printing point, and underneath the ink ribbon 61. The feed of the record strip is step by step during the operation of the machine, the strip being advanced one step following each actuation of the printing hammers. This feed is accomplished by rotative movement imparted to the lower feed roller 73. This roll is mounted on shaft 77, upon which is mounted a gear wheel 78, with which meshes an idler gear 79, journaled on a stud carried by one of the side pieces 21 of the supplementary frame, and which, in turn, is driven by a gear 80, carried by shaft 22. This gear 80, is driven frictionally by being interposed between collar 43, and a collar 81, both mounted upon shaft 22, the collars 43 and 81, rotating with said shaft, as above explained.

In the proper operation of the apparatus, it is important that the feed of the record strip be effected during the upward movement of the bar 65, carrying the printing hammers, and it is equally important that this advancement or feed of the record strip be effected quickly in order that a fresh surface of the record strip may be presented at the printing point, even though the printing hammers may be actuated in close succession. To accomplish this result, I propose to rotatively actuate the lower feed roll 73, through a spring tension. One arrangement for accomplishing this is shown in Fig. 16, wherein a coiled spring 82, is mounted upon the shaft 77, of feed roll 73, and has one end secured to said roll, the other end being secured to the hub of gear 78. The gear 78, is loosely sleeved upon shaft 77, while the roll 73, is fixed to rotate with said shaft. With this arrangement, it will be seen that rotations imparted to gear 78, serve to wind up the coiled spring 82, which forms the sole connection between the gear 78, and the roll 73, so that the roll 73, is under a rotative tension due to the spring

83. The roll 73, however, is prevented from being rotated by means of a lever 83, pivotally mounted, as at 84, see Figs. 11, 12 and 15, upon one of the side pieces 21 of supplementary frame to swing laterally with reference thereto. The hooked end 84, of this lever operates in a ratchet groove 85, formed in the peripheral surface of the feed roll 73. A spring 86, interposed between the side piece 21 of the supplemental frame and lever 83, normally acts to rock said lever into position for the hooked end 84 thereof, to engage in front of a shoulder 87, formed in the cam groove 85, thereby holding the roll 73 against rotative movement. While so held, the drive gear 80, from which rotative movement is transmitted to the feed roll 73, is permitted to slip rotatively between the collars 43, 81, while still imposing through spring 82, the rotative tension upon the feed roll 73, whereby the instant the hooked end 84, of lever 83, is disengaged from shoulder 87, the feed roll is free to instantly take up a quick rotative movement, due to the tension of the coiled spring 82. The lever 83, is designed to be rocked against the action of spring 86, and so as to detach the hooked end 84, thereof from engagement with shoulder 87, by the rocking movement of frame or yoke 57, during the elevation of the printing hammers. The swinging or rocking yoke or carrier 57, carries a spring pressed dog 88, which, during that movement of said carrier frame 57, which elevates the printing hammers 60, engages a lug or inclined surface 89, on the lever 83, thereby pressing the same outwardly against the action of spring 86, and in a direction to shift the hooked end 84 thereof out of engaging relation with respect to shoulder 87, this tripping action taking place, as above indicated, during the rising movement of the printing hammers after having delivered a printing blow. The instant the hooked end 84, clears shoulder 87, the feed roll 73, immediately takes up a rotative movement, the cam slot 85, guiding the hooked end 84, into position to arrest a further rotative movement of the feed roll, by engagement with the next succeeding shoulder 87, in the peripheral cam groove 85. Thus, after each printing stroke of the hammers, the record strip is advanced a definite distance, determined by the spatial relation of the shoulders 87, in the peripheral cam groove 85. The extent of vertical movements of the printing hammers may, if desired, be adjustably regulated by an adjustable set screw 90, see Fig. 12.

The upper feed roll 74, which coöperates with roll 73, the operation of which has just been described, is in the nature of a presser roll, being held for slight, vertical yielding movement by means of springs 91, bearing upon the pintles 92, carrying said presser roll 74, and operating through vertical, elongated slots 93, see Fig. 9, in the side pieces 21, of the supplemental frame.

The hammer carrying yoke of frame 57, may be actuated to deliver the desired hammer blow in any suitable or convenient manner. I have shown said yoke actuated by means of an electromagnet 94, the portion 95, of the frame 57, forming the armature for said magnet.

The means for controlling the circuit connections for these magnets will presently be described. If desired, and in order to prevent any back lash or retrograde movement of the feed roll 73, a spring pressed pawl 96, may coöperate with the teeth of gear 80, as shown in Fig. 9.

In the practical operation of the apparatus, and in order to secure absolute timing accuracy, it is necessary to provide means for securing as nearly absolute accuracy in the time required for the printing wheels to rotatively actuate as possible. It is exceedingly difficult, in practice, to secure the rotation of a motor, or of a shaft driven from the motor, with absolute accuracy as to the time required to complete a cycle of operation, as, for instance, the time required to effect a complete rotation of a driven shaft. In accordance with the principles of my invention, I propose to synchronize the speed or rate of speed of the shaft 22, which drives and actuates the printing wheels, with reference to a ship's chronometer, or other accurate timepiece. In carrying out my invention, I mount a cross bar 97, to rotate with shaft 22, the ends of said bar coöperating with the end 98, of a movable stop 99. This movable stop is connected to or forms part of the armature 100, of an electromagnet 101, said armature being pivotally mounted, as at 102, in a yoke 103, attached to the side piece 21 of the supplemental frame. The operation is so timed that when the armature 100, is attracted by the electromagnets 101, the end 98, of the stop is in position to be engaged by the end of one or the other of the arms of bar 97, thereby arresting the rotative movement of shaft 22. When the armature 100, is not attracted by the electromagnets 101, it is raised or rocked limitedly upwardly by a spring 104. I also propose to so control the circuits of magnets 101, by the chronometer or other timepiece, that said circuits will be completed, and the magnets energized regularly at each second, or other desired interval of time, and if the rotations of shaft 22, are not in proper time, then the arms of bar 97, will be arrested and the rotative movement of shaft 22 will be detained so long as the armature 100, remains depressed. Where the bar 97 is provided with two arms, I am afforded means for thus controlling the accuracy of the rate of speed of rotation of

shaft 22, at each half revolution thereof, so, for instance, at each second of time, by suitably energizing the magnets 101 at each second of time. In practice, I prefer to so proportion the relative speeds of the parts that when the apparatus is operating in due orderly and accurate manner, the ends of the bar 97, will strike the movable stop 98, a very small fraction of a second before the circuit of the electromagnets is opened by the operation of the chronometer.

In order to disclose by inspection whether or not the synchronizing apparatus above described is operating properly, I employ an indicator, indicated generally at 105, Fig. 1, comprising a pointer 106, operated by a magnet 107, the coils of which are in circuit with the arm 97, and the movable contact 98, these latter parts being suitably insulated from the frame in a well known manner. The arrangement is such that whenever one or the other ends of the bar 97, contacts with movable stop 98, the circuit of the coil of magnet 107, is completed, thereby actuating the pointer arm 106, and hence disclosing visually whether or not the synchronizing apparatus is in proper operation. This circuit may be supplied with current from any suitable or convenient source, and I have indicated at 108, a battery for this purpose.

The circuit connections of the magnets 94, which actuate the printing hammer are controlled by electromagnets 109. The armature 110, of these controlled magnets 109, controls circuit terminals 111, 112, which are included in the circuit of the hammer actuating magnets 94. This circuit arrangement is illustrated diagrammatically in Fig. 2, current being supplied from any convenient source, as for instance, a battery 112^a, and the arrangement being such that when the circuit of control magnet 109, is broken, the circuit of magnets 94, is closed, a spring 113, or other suitable means being employed to move the armature 110, into position to close the circuit of magnets 94, when magnets 109 are deënergized. The circuit of control magnets 109, may be supplied with current from any suitable or convenient source, such, for instance, as a a battery indicated at 114. This circuit is arranged to be closed at the commencement of the movement, the speed or time of which is to be recorded by the apparatus. Where, for instance, the elapsed time of an automobile race is to be recorded, I provide means arranged to be operated at the instant the race commences, which will open the circuit of the control magnet 110, for an instant of time, the circuit of said magnet being normally closed. Thus, as indicated in Fig. 2, I may employ a wire 116, stretched across the track, and over which the automobile, the speed of which is to be timed, runs at the instant the race or the run begins. This may be of any suitable arrangement for opening the circuit, for instance, through the tension imposed by the automobile on the wire or other connection stretched across the track at the starting point. This wire or other connection is connected to a switch device arranged in the circuit of the control magnet, and is suspended across the path of the automobiles at a slight elevation above the surface of the roadway. The instant the automobile wheels strike this wire, the circuit of magnet 110 is opened. The instant this circuit is opened, the circuit of the printing hammer actuating magnets 94, is closed, and said hammers deliver a printing blow, thereby instantly recording the instant of time at which the trap device 116, has been actuated by the automobile passing thereover. After the automobile wheels have passed over this trap device, the circuit control magnet 110, is again closed, thereby opening the circuit of the printing hammer actuating magnets 94, the printing hammers consequently remaining in their raised position. Similarly, at the end of the movement, the speed or time of which is to be recorded, as, for instance, at the end of the race, or at the mile, half mile, or other point in the race, a similar circuit opening trap or device 117, is employed, which, by the passage of the automobile thereover, operates to again momentarily open the circuit of control magnets 110, consequently closing the circuit of the printing hammer actuating magnets 94, and causing a printing blow to be delivered by the hammers, and hence recording the instant of time when the automobile reaches the point at 117 in the race. The elapsed time between these two records indicates the time consumed by the automobile in traversing the distance between the points where the traps 116, and 117, are located.

In order to operate the synchronizing magnets 101, by currents stronger than that which it is desirable that the chronometer may control, I propose to employ a relay magnet 118, arranged to control the circuits of the synchronizing magnets 101, the circuits of the relay magnet 118, being in turn controlled by the chronometer not shown, in such manner that at each desired interval of time, as, for instance, at each second of time as recorded by the chronometer, the circuit of relay magnet 118, is completed. The completion of the circuit of this magnet effects the actuation of the armature 119, thereof, to which is connected the rocking member 120, through which circuit contact strips 121, are opened and closed, these contact strips being included in the circuit of the synchronizing magnets 101. In practice, I prefer to so adjust and arrange the relay magnet and associate connections that the circuit of the synchronizing magnets is

opened whenever the circuit of the relay magnet is opened at any point in the system, thereby permitting the shaft 22, to continue to rotate. I have found, in practice, that this is more advantageous than to close the circuits of the synchronizing magnets in case of derangement of opening of the circuit of the relay magnets or other part of the system.

In the practical use of the apparatus, it may be desirable to cut out or short circuit the trap connections 116, 117, and to control the circuits of said traps at the instrument itself. For this purpose I employ contact switches indicated at 122, 123, for opening or closing the circuit system at the instrument, as, for instance, at the points indicated at 125, 126, in the circuit diagram of Fig. 2. At 127, I have shown a series of contacts, which may be employed for properly coupling up the entire system by the insertion of suitable circuit plugs therein. Thus, I may use the circuit for telephone purposes by properly plugging into one of these contacts 127, suitable telephone receiver or transmitter connections. Similarly, I may employ plugs for controlling through one or the other of the contacts 127, the battery current, and so on, as indicated in Fig. 4.

I have above indicated that the recording may be effected to a degree of accuracy to within a very small fraction of a second, say, for instance, to within one-hundredth part of a second. In this connection, however, my invention as defined in the claims is not to be limited or restricted, as even a greater degree of accuracy may be accomplished by increasing the size or diameter of the printing wheels and employing a greater number of printing elements on the peripheries thereof. In the arrangement shown, I provide the periphery of the first wheel 34, which I have called the one-hundredth second wheel, with printing characters indicating successive intervals of five-one-hundredths part of a second, as five, ten, fifteen, and so on. In order to secure a greater degree of accuracy, I also provide periphery of wheel 34, with printing or designating marks 130, see Figs. 4, and 6, divided into even smaller subdivisions, that is, separating the space between adjacent numerals into five equal divisions, which are similarly reproduced on the record strip with each printing action of the hammers, thereby indicating the exact time to within the one-hundredth part of a second.

While I have described the various structures forming parts of my invention in the specific details of their shown embodiments I desire it to be understood that my invention, in its broadest scope and as defined in the claims, is not to be limited or restricted to the specific details of structure, location and arrangement of parts shown and described. But

Having now set forth the object and nature of my invention, and a construction embodying the principles thereof, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent is:—

1. In an automatic race time recording device, the combination with record printing wheels and a coöperating reciprocating printing platen arranged to operate at a predetermined rate, and means for maintaining said rate of operation uniform, of means arranged in the path of the body or part, the speed of which is to be timed, and adapted to be actuated thereby, for controlling the operation of the printing wheels and platen.

2. In an automatic race time recording device, the combination with printing wheels and a coöperating printing platen actuating means therefor, arranged to operate the same at a definite rate, and means for maintaining said rate of operation uniform, of means arranged in the path of the body or part, the speed of which is to be timed, and adapted to be operated thereby, for controlling said actuating means.

3. In an automatic race time recording mechanism, the combination of printing wheels and a coöperating printing platen, electrical means for operating the same, means for periodically correcting the time rate of operation of said devices and means located in the path of the body or part, the speed of which is to be timed, for controlling the circuit of said electrical means.

4. In an automatic race time recording mechanism, the combination of rotatable printing wheels and a coöperating printing platen, electrical means for controlling the same, a normally closed circuit for said electrical means, and means arranged in the path of the body or part, the speed of which is to be timed, to be operated thereby, for momentarily opening said circuit.

5. In an automatic race time recording mechanism, the combination with circuit controlling means located in the path of the body or part, the speed of which is to be timed, and adapted to be operated thereby, of rotatable printing wheels and a coöperating printing platen for recording time, means arranged in the circuit of said circuit controlling means for controlling the operation of the printing wheels and platen, and devices for correcting variations in the speed rate of operation of said printing devices.

6. In an automatic race time recording mechanism, the combination with circuit controlling means located in the path of the body or part, the speed of which is to

be timed, and adapted to be operated thereby to open an electric circuit, of rotatable printing wheels and a coöperating printing platen for recording time, means operated by the opening of said circuit for actuating the printing wheels and platen, and means for automatically maintaining the rate of operation of the printing devices uniform.

7. In an automatic race time recording mechanism, the combination with circuit controlling means located in the path of the body or part, the speed of which is to be timed, and adapted to be operated thereby to open an electric circuit, of printing wheels and a coöperating platen for recording time, actuating means therefor, means for automatically maintaining the rate of operation of the printing devices uniform, and means operated by the opening of said circuit for controlling the actuating means of the printing wheels and platen.

8. In an automatic race time recording mechanism, the combination of printing devices including printing wheels and a platen coöperating therewith, means for operating the printing wheels at a predetermined time rate, and means rendered operative by the movement of the body or part, the speed of which is to be timed, for controlling the operation of the printing platen.

9. In an automatic race time recording mechanism, the combination of printing wheels, means for rotatively displacing the same at a definite time rate, a platen coöperating with the printing wheels, and means rendered operative by the movement of the body or part, the speed of which is to be timed, for controlling the operation of the printing platen.

10. In an automatic race time recording mechanism, the combination of printing wheels mounted for rotative displacement, means for rotatively displacing one of said wheels at a definite time rate, means operated by the rotative displacement of said wheel for rotatively displacing the next adjacent wheel, printing hammers coöperating with said wheels, and means operated by the movement of the body or part, the speed of which is to be timed, for controlling the operation of the printing hammers.

11. In an automatic race time recording mechanism, the combination of printing wheels, friction drive devices for rotatively displacing said wheels, printing hammers coöperating with said wheels, and means operated by the movement of the body or part, the speed of which is to be timed, for controlling the operation of the printing hammers.

12. In an automatic race time recording mechanism, the combination with printing wheels, a shaft upon which they are mounted, and frictionally coupled means for driving said shaft, of printing hammers, coöperating with said wheels, and means operated by the movement of the body or part, the speed of which is to be timed, for controlling the operation of the printing hammers.

13. In an automatic race time recording mechanism, the combination with printing wheels, a shaft carrying the same, a motor for driving the shaft at a definite speed, and record making devices coöperating with said printing wheels, of means operated by the movement of the body or part, the speed of which is to be timed, for controlling the operation of the record making devices.

14. In an automatic race time recording mechanism, the combination with printing wheels, a shaft carrying the same, a driving motor, a frictional coupling between the motor and shaft, and record making devices cooperating with said printing wheels, of means operated by the movement of the body or part, the speed of which is to be timed, for controlling the operation of the record making devices.

15. In an automobile race time recording mechanism, the combination with rotatable printing wheels and a coöperating reciprocating printing platen, means for moving the printing wheels at a definite time rate, and means for automatically maintaining said time rate uniform, of means operated by the movement of the body or part, the speed of which is to be timed, for controlling the operation of the printing platen.

16. In an automatic race time recording mechanism, the combination of printing wheels and coöperating reciprocating platen, means for moving the printing wheels, means for automatically controlling the time rate of such movement, and means operated by the movement of the body or part, the speed of which is to be timed, for controlling the operation of the printing platen.

17. In an automatic race time recording mechanism, the combination of printing wheels, a shaft on which said wheels are mounted, means for frictionally driving said shaft, said wheels being frictionally driven by said shaft, record making devices coöperating with the printing wheels, and means operated by the movement of the body or part, the speed of which is to be timed, for controlling the operation of the record-making devices.

18. In an automatic race time recording mechanism, the combination of printing wheels and record-making devices coöperating therewith, means for imposing a tension upon the printing wheels tending to rotate the same, and means operated by the movement of the body or part, the speed of which is to be timed, for controlling the operation of the record-making devices.

19. In an automatic race time recording mechanism, the combination of printing wheels and record-making devices coöperat-

ing therewith, means for imposing a tension upon the printing wheels tending to rotate the same, restraining means to release the printing devices, and means operated by the movement of the body or part, the speed of which is to be timed, for controlling the operation of the record-making devices.

20. In an automatic race time recording mechanism, the combination of printing and record-making devices, means for moving the printing wheels, means for automatically synchronizing said moving means periodically in accordance with a predetermined time rate, and means controlled by the movement of the body or part, the speed of which is to be timed, for operating the record-making devices.

21. In an automatic race time recording mechanism, the combination with a shaft, printing wheels loosely sleeved thereon, collars carried by said shaft to rotate therewith and frictionally engaging said wheels, pawl and ratchet mechanism operated by each wheel to control the movements of the next adjacent wheel, means for driving said shaft at a predetermined time rate, of record-making devices coöperating with the printing wheels, and means controlled by the movement of the body or part, the speed of which is to be timed for operating the record-making devices.

22. In an automatic race time recording mechanism, the combination with a shaft, printing wheels loosely sleeved thereon, collars carried by said shaft to rotate therewith and frictionally engaging said wheels, means connecting the wheels and collars and tending to impart rotative tension to the wheels, pawl and ratchet devices for controlling the rotative movements of the wheels, means for driving the shaft at a predetermined time rate, of record-making devices coöperating with the printing wheels, and means controlled by the movement of the body or part, the speed of which is to be timed, for operating the record-making devices.

23. In an automatic race time recording mechanism, the combination with a shaft, printing wheels loosely mounted thereon, means for imposing a rotative tension to said wheels, friction devices for coupling the wheels to rotate with the shaft, pawl and ratchet mechanism for controlling the rotative movements of said wheels, and means for rotating said shaft at a predetermined rate, of record-making devices coöperating with the printing wheels, and means controlled by the movement of the body or part, the speed of which is to be timed, for operating the record-making devices.

24. In an automatic race time recording mechanism, the combination with a shaft, collars mounted thereon, printing wheels carried by said collars, springs connected respectively to the collars and to the wheels, and means for rotating said shaft at a definite rate of speed, of record-making devices associated with the printing, and means controlled by the movement of the body or part the speed of which is to be timed, for operating the record-making devices.

25. In an automatic race time recording mechanism, the combination with a shaft, hubbed collars loosely mounted thereon, printing wheels carried by the hubs of said collars, springs respectively connected to the wheels and collars, means for frictionally connecting the collars to rotate with the shaft, and means for rotating the shaft at a predetermined speed, of record-making devices coöperating with the printing wheels, and means controlled by the movement of the body or part, the speed of which is to be timed, for operating the record-making devices.

26. In an automatic race time recording apparatus, the combination of printing and record-making devices, including a record strip feeding device and a reciprocating printing platen, means for moving the printing and record strip feeding devices step by step at a predetermined time rate, means for automatically synchronizing said time rate of operation periodically and means controlled by the movement of the body or part, the speed of which is to be timed, for operating the printing platen.

27. In an automatic race time recording mechanism, the combination with a shaft, printing wheels loosely mounted thereon, friction collars also mounted on said shaft and interposed between the printing wheels, means for yieldingly pressing said wheels and collars laterally against each other, and means for rotating said shaft at a predetermined rate, of record-making devices coöperating with the printing wheels, and means controlled by the movement of the body or part, the speed of which is to be timed, for operating the record-making devices.

28. In an automatic race time recording mechanism, a shaft, a series of printing wheels loosely mounted thereon, one of said wheels being a driving wheel, a collar also mounted on said shaft to rotate therewith, a pawl and ratchet mechanism connecting said collar and driving wheel, pawl and ratchet mechanism controlled by each wheel for actuating, step by step, the next adjacent wheel, and means for rotating said shaft at a predetermined rate, in combination with record-making devices coöperating with the printing wheels, and means controlled by the movement of the body or part, the speed of which is to be timed for operating the record-making devices.

29. In an automatic race time recording mechanism, the combination of printing and

record-making devices, means for actuating the printing devices at a predetermined time rate, stop mechanism for retaining the printing devices in zero position, and means operated by the actuation of the record-making devices for releasing the stop mechanism.

30. In an automatic race time recording mechanism, the combination of printing and record-making devices, means for actuating the printing devices at a predetermined time rate, stop mechanism for restraining the movement of the printing devices when in zero position, means controlled by the movement of the body or part, the speed of which is to be timed, for operating the record-making devices and means operated by the actuation of the record-making devices for releasing the stop mechanism.

31. In an automatic race time recording mechanism, the combination of printing wheels, one of said wheels being a driving wheel for the others, means for imparting a rotative tension to said driving wheel, stop mechanism for restraining said wheel from rotation when in zero position, record-making devices coöperating with the printing wheels, means controlled by the movement of the body or part, the speed of which is to be timed, for operating the record-making devices, and means operated by the actuation of the record-making devices for releasing the stop-mechanism.

32. In an automatic race time recording apparatus, printing wheels, connections intermediate said wheels for driving the one step by step from the next adjacent one, a drive wheel, a dog carried by one of the printing wheels to engage the drive wheel, a stop on the dog-carrying printing wheel, a lever arranged to engage the dog and stop to release the drive gear and arrest the said printing wheel, record-making devices, and means actuated by the operation of the record devices for releasing said lever from engagement with the stop and dog.

33. In an automatic race time recording apparatus, printing devices, a drive wheel therefor, a dog for engaging said drive wheel to operate the printing devices, a stop lever for releasing the dog, a record-making carrier plate, and means operated by the actuation of said plate for releasing said lever.

34. In an automatic race time recording apparatus, printing devices, means for frictionally driving the same including a dog, means for releasing said dog, including a spring pressed lever, record making devices, a carrier plate therefor, a lug on said plate to engage the lever to hold the same in place to release the dog, and means controlled by the body or part, the speed of which is to be timed, for moving said carrier plate to make a record and release said lever and dog.

35. In an automatic race time recording apparatus, the combination with printing devices, and means for operating the same, of record-making devices including a movable carrier plate, printing hammers carried thereby, means normally maintaining the carrier plate retracted, and means operated by the body or part, the speed of which is to be timed, for moving said plate to cause the hammers to deliver a printing blow.

36. In an automatic race time recording apparatus, the combination with printing devices, means for operating the same at a predetermined rate, and stop devices for arresting said devices in predetermined position, of record-making mechanism coöperating with the printing devices, means operated by the movement of the body or part, the speed of which is to be timed for actuating the record-making devices, and means operated by the actuation of the record-making devices for releasing said stop devices.

37. In an automatic race time recording apparatus, the combination with printing devices, means for operating the same at a predetermined rate, and stop devices for arresting said devices in an initial position, of record-making devices including a movable carrier plate, printing hammers loosely mounted therein, means normally operating to maintain said plate in retracted position, means operated by the movement of the part or body, the speed of which is to be timed, for actuating said plate to cause the hammers to deliver a printing blow on the printing devices, and means operated by the actuation of said plate for releasing said stop devices.

38. In an automatic race time recording apparatus, and in combination with printing devices, and means for operating the same at a predetermined rate, of record-making devices, including a rocking plate, printing hammers, springs for yieldingly supporting said hammers on said plate, means for normally maintaining said plate retracted, and means operated by the movement of the part or body, the speed of which is to be timed, for actuating said plate.

39. In an automatic race time recording apparatus, and in combination with printing devices, and means for operating the same at a predetermined rate, of record-making devices including a rocking plate, printing hammers having headed stems loosely supported in said plate, springs interposed between the heads of said stems and the plate, means normally operating to maintain said plate in retracted position, and means operated by the movement of the body or part, the speed of which is to be timed, for rocking said plate.

40. In an automatic race time recording apparatus, and in combination with print-

ing devices and means for operating the same at a predetermined rate, of record making devices including printing hammers, means for moving a record strip and ribbon between the hammers and the printing devices, and means operated by the movement of the body or part, the speed of which is to be timed, for actuating the printing hammers.

41. In an automatic race time recording apparatus, and in combination with a table having an opening, printing devices arranged beneath the opening in said table, and means for operating said printing devices at a predetermined rate, of means for operating an ink ribbon and a record strip over the opening in said table, printing hammers coöperating therewith, and means actuated by the movement of the body or part, the speed of which is to be timed for operating the printing hammers.

42. In an automatic race time recording apparatus, and in combination with printing devices, and means for operating the same at a predetermined speed, of record making devices including printing hammers, record strip and ink ribbon feeding devices, means operated in unison with the printing devices for feeding the record strip, and means operated by the movement of the body or part, the speed of which is to be timed, for actuating the printing hammers.

43. In an automatic race time recording apparatus, and in combination with printing devices, and means for operating the same step by step at a predetermined rate, of printing hammers, means operated by the movement of the body or part, the speed of which is to be timed, for actuating the printing hammers, means for feeding a record strip between said hammers and printing devices, and means operated by the actuation of the printing hammers for operating the record strip feeding means.

44. In an automatic race time recording apparatus, and in combination with printing devices, and means for operating the same at a predetermined speed, of printing hammers, means for feeding a record strip between the hammers and the printing devices including feed rolls, means for imparting a rotative tension to one of said rolls, a stop mechanism for controlling the rotations of said roll, means controlled by the movement of the part or body, the speed of which is to be timed, for actuating said printing hammers, and means operated by the actuation of said hammers for releasing said stop mechanism.

45. In an automatic race time recording apparatus, and in combination with printing devices, and printing hammers, means for operating the printing devices at a predetermined rate, and means controlled by the movement of the part or body, the speed of which is to be timed, for actuating the printing hammers, of feeding rolls arranged to feed a record strip between the hammers and printing devices, a ratchet mechanism for actuating one of said rolls, and means operated by the movement of the printing hammers for controlling said ratchet mechanism.

46. In an automatic race time recording apparatus, and in combination with printing devices, and printing hammers, means for operating the printing devices at a predetermined rate, and means controlled by the movement of the part or body, the speed of which is to be timed, for operating the printing hammers, of feeding rolls arranged to feed a record strip between the hammers and printing devices, means for imparting a constant rotative tension to one of said rolls, ratchet mechanism for restraining the rotative movement of said roll, and means operated by the movement of the printing hammers for controlling said ratchet mechanism.

47. In an automatic race time recording apparatus, and in combination with printing and record-making devices, including record strip feeding devices and a coöperating reciprocating printing platen, and means for actuating the printing and feeding devices, of means controlled by a time piece for automatically synchronizing the printing and record strip feeding device actuating means periodically.

48. In an automatic race time recording apparatus, and in combination with printing and record-making devices, including record strip feedings devices and a coöperating reciprocating printing platen, and means for actuating said devices, of electrically controlled means for automatically synchronizing the operation of the printing device actuating means periodically at a predetermined time rate.

49. In an automatic race time recording apparatus, and in combination with printing and record making devices, including record strip feeding devices and a coöperating reciprocating printing platen, and means for actuating the same, of a synchronizing mechanism for the printing and record strip feed actuating means, including a stop device, and clock controlled devices for operating said stop device.

50. In an automatic race time recording apparatus, and in combination with printing and record making devices, including record strip feed, printing wheels and a printing platen, and means for actuating the same, of stop arms operated by the printing wheel actuating means, a coöperating stop device, and clock controlled mechanism for operating the stop device.

51. In an automatic race time recording

apparatus, and in combination with printing and record making devices, including record strip feeding devices, rotatable printing wheels, and a coöperating printing platen, a motor driven actuating shaft for the printing wheels, stop arms carried by said shaft, a movable stop device coöperating with said stop arms, to regulate the speed rate thereof, a clock controlled mechanism for moving said stop device periodically.

52. In an automatic race time recording apparatus, and in combination with printing and record making devices, including record strip feeding devices, rotatable printing wheels, and a coöperating printing platen, a motor driven means for operating the printing wheels and platen, a coöperating movable stop device for regulating the timing rate of speed of said motor driven actuating means, and a clock controlled means for operating said stop device.

53. In an automatic race time recording apparatus, and in combination with printing and record making devices, including record strip feeding devices, rotatable printing wheels, and a coöperating printing platen, a motor driven means for actuating the same, of a coöperating movable stop device for regulating the speed rate of said motor driven actuating means, a magnet for moving said stop device, a clock actuated means for controlling the circuit of said magnet.

54. In an automatic race time recording apparatus, and in combination with printing and record making devices, a motor driven means for actuating the same, of a coöperating movable stop device for regulating the speed rate of said motor driven actuating means, clock controlled devices for periodically moving said stop device, and an indicator controlled by said stop device.

55. In an automatic race time recording apparatus, and in combination with printing and record making devices, a motor driven means for actuating the same, of a movable stop device for regulating the stop rate of said motor driven actuating means, clock mechanism for periodically moving said stop device, an indicator, a magnet for operating the same, said stop device arranged to control the circuit of said magnet.

56. In an automatic race time recording apparatus, the combination with printing and recording mechanism including a rocking plate carrying printing hammers, of a magnet for operating said plate, a normally closed circuit for said magnet, a switch device arranged in said circuit, a magnet for controlling said switch device, a means arranged in the path of the body or part, the speed of which is to be timed, for momentarily closing the circuit of the last mentioned magnet as said body or part passes thereover.

57. In an automatic race time recording apparatus, and in combination with printing and record making devices, including record strip feeding devices, rotatable printing wheels and a coöperating printing platen, a motor driven means for actuating same, of a movable stop device actuated for regulating the time rate of said motor driven actuating means, a magnet for controlling the said movable stop device, a relay for controlling the circuit of said magnet, and a clock actuated means for controlling the circuit of said relay.

In testimony whereof I have hereunto set my hand in the presence of the subscribing witnesses, on this 19th day of February, A. D. 1910.

CHARLES H. WARNER.

Witnesses:
H. W. ADAMS,
J. C. HOWELL.