The Papers of Thomas A. Edison

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The year 1872 was a remarkably creative one for Edison. He executed thirty-nine successful patent applications, nearly twice as many as in all of his previous career. In only two other periods would he exceed his 1872 patent productivity level: the years 1880–83, when he developed his incandescent lighting system, and the year 1888, when he worked on his improved phonograph. The early part of 1872 witnessed his most intense creative work of that year. He returned from his honeymoon at the beginning of the year and during the next month and a half generated an unusually large number of notebook entries. These were concerned primarily with improvements in printing and automatic telegraphs and with his initial work on district telegraphs, a system that businesses and individuals could use to request messenger and other services. Edison also formed a new manufacturing partnership with the mechanic Joseph Murray, an association that soon grew in importance and continued for more than three years.¹

In January and February, Edison vigorously pursued printing telegraphy, filling his notebooks with design variations for his universal stock printer and his universal private-line printer. At that time he also devoted a notebook to illustrating more than a hundred different escapement mechanisms for possible use in printing telegraphs.² His work on the universal private-line printer initially proved unsuccessful, but he abandoned the original design in March and had developed a new one by April. In the new design, Edison adapted his universal stock printer as the printing portion and improved the accuracy and precision of the private-line transmitter. He also fitted the new instruments with his screw-thread unison.
In the spring Edison began to manufacture both his universal stock printer and his universal private-line printer for the Gold and Stock Telegraph Company. Officers in Gold and Stock also held an interest in the Exchange Telegraph Company of London; accordingly, when this English establishment began operations late in the spring of 1872, it employed Edison's universal stock printer on its lines.3

Edison's prodigious inventive activities also extended to automatic telegraphs, where he focused on perforator designs. He introduced improvements in the mechanical design and punches of his large perforator and executed a patent for a small, six-key instrument (U.S. Pat. 132,456) that could be used by local offices or by customers. Other elements of the system also received his attention. Because tailing continued to be the principal drawback to high-speed automatic telegraphy, Edison began seriously to pursue circuit designs that would prevent this problem. Also seeking to produce a reliable device for transcribing messages, he transformed his universal private-line printer into an electric typewriter and improved his ink recorder. With the latter he attained an experimental speed of 1,800 words per minute.

Both the American Telegraph Works and Edison and Unger continued to supply instruments to the various offices of the Automatic Telegraph Company, but technical problems delayed the public introduction of the system. In preparation for business, Automatic Telegraph initiated negotiations with the Southern and Atlantic Telegraph Company, hoping particularly to extend Automatic Telegraph's service to New Orleans.

In the early winter Edison also turned his attention to district telegraphy. In mid-January he made extensive notes regarding improvements, and these became the basis for a caveat he signed a couple of days later. He assigned the caveat to the American District Telegraph Company,4 which Edward Calahan, George Field, and Elisha Andrews had created in October 1871 for the purpose of exploiting Calahan's newly invented district telegraph. Calahan's instrument allowed individuals to signal for messenger and other services from their homes and businesses.5

The flurry of inventive activity suggested by Edison's January and February notebook entries probably continued in the form of product development as Edison put the universal instruments into production the following spring and summer. The number of formal notebook entries declined sharply in
this period, but informal and undated sketches continued to abound.6

1. In February, Edison and Murray established a small manufacturing shop, Murray & Co., on New Jersey Railroad Ave. In May they moved their shop to Oliver St. Murray's testimony, Quad. 71.1, p. 29; gas receipts, 72-001, 72-019, DF (TAEM 12:662, 919).
2. Escapement Notebook, February 1872, MiDbEI; Georges d'Inreville to TAE, 15 Dec. 1910, GF.
4. See Docs. 226, 228, and 229; and Digest Pat. E-21192-93.
5. Gibson and Lindsay 1962, 21-22.
6. See unbound telegraph notes and drawings, NS-Undated-005, Lab. (TAEM 8:207-504). Some of these may date from the second half of 1872.

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Newark Jan 1st 1872

E & U Stock a/c

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tools &amp; Machinery</td>
<td>$16,776.76</td>
</tr>
<tr>
<td>Finished &amp; unfinished stock</td>
<td>$8,644.49</td>
</tr>
<tr>
<td>Raw Stock</td>
<td>$1,261.34</td>
</tr>
<tr>
<td>Bills due us not Collected</td>
<td>$2,240.66</td>
</tr>
<tr>
<td>Bills we owe not Paid</td>
<td>$6,045.53</td>
</tr>
</tbody>
</table>

Total value $28,923.45

Note from Wm Unger $3,649.42

T A Edison Resource $15,088.58

D, NJWOE, DF (TAEM 12:809). Written by Joseph Murray, on paper torn from a ledger.

1. "a/c" means account.
2. In another version of this yearly statement, this amount is given as $17,656.76, for a total of $29,803.45 for machinery, stock, and bills, which amount is written in the left margin of this document in another hand. Cat. 1185:378, Accts. (TAEM 22:704); see also ibid., 16 (TAEM 22:570).
3. Regarding the note from Unger, see Docs. 197 and 264.
The above drawing is a sketch of my Locking device, the object of which is to place a number of my Universal Stock Printers on one circuit or circuits, and lock or unlock any one or any number from a Central Station upon that circuit. I will copy here a caveat which I have previously prepared:

"The object of this invention is to prevent any printing instrument among a number in the same circuit from printing, all or any of them.

"The invention consists of an attachment to one of my Universal Stock Printers which work upon one or two wires according to the circuit devices used. The attachment is throwing the lock wheel by means of the shifting devices into a forked lock piece attached to the Printing Lever, which piece acts as a lock to the type wheel and also as a block or impediment to the bringing of the Printing Lever to the face of the type wheel and making an impression. The fraction wheel has been dispensed with, and use the shifting devices merely to lock and unlock the type wheels. In these lock wheels there are a slight opening through which the type wheel arm passes at the moment of shifting, on every machine composing a circuit. The shifting devices are set in different positions so that one type wheel only of all the instruments can be shifted at a time, and unlike the ordinary mode shift all at the same time on all instruments, and also in this case I shift only when the type wheel lever is down and the magnet closed, and print when it is up. Thus preventing any of the type wheels of the several machines from shifting while transmitting a message to a particular instrument, which would be the case were I not to use a closed circuit on the Escapement Lever to do the shifting. I will mention here that after the lock wheel has been thrown into the fork, there is a slight dead motion between it and the fork which allows the Printing Lever to come up towards the face of the type wheel far enough to release the unison but not enough to effect an impression or move the paper any great distance. This fork performs two functions. The first, preventing the type wheel from jarring..."
out or moving except in one position, and of preventing the Printing Lever from effecting an impression =

I have previously said that I dispense with the figure fraction Wheel, but this is not necessary as a second shifting devices may be attached to the ordinary Universal Stock which second shifting devices may be made to throw a disk in & out of a fork on the Printing Lever thus Locking or unlocking as is required, this second shifting device being operated when the type wheel circuit is closed while the ordinary shift devices is operated as commonly or formerly when the type wheel circuit is Open.

I do not wish to confine myself to any particular device for unlocking and locking, because they would be different according as they are attached to the various machines now in the market. I believe at this time of writing that I am the originator of the idea of locking & unlocking a number of step by step Magnetic Printing Machines in one or more circuits from a central Station.

I am aware that Hughes has an arrangement for unlocking & Locking his machines, but the machines used in the Stock reporting business, are on altogether different principles from the Hughes =

I will mention here that there are numerous ways of effect the Lock and unlocking, both electrically and mechanically. One of the various modes is to have a separate magnet work a ratchet wheel, and this ratchet wheel having pins on it on upon its shaft may be thrown in the path of the Printing Lever and prevent it from Printing as long as it remains. This magnet should be polarized—or have double helix and be effected by closure of both cks. Another mode is to dispense with the shifting of the type Wheel and its shifting devices on the shaft, and place them rigid upon the base attaching two pins only to the shaft thus

as in my shifting pad instrument already Patented

A Cut in and out device might be used. This would consist of a polarized magnet working an escapement, on the shaft of which an arm might project rubbing on a periphery of metal
having one insulating opening. Every instrument being provided with one of these, the insulated places being in different positions, and the magnet placed in the Printing ckt it might be made to revolve by intermitting a positive current and Cut out all the Printing magnets by reason of the arm remaining on the metallic ring and if it was desired to cut in any printing magnet the extra magnet would be rotated until the arm Came to an insulated opening when the short cut would be destroyed and the Ptg magnet would be in Ckt while all the other machines would be out Then by using a negative Current which would not effect the directive polarized magnet, the message Could be Sent on that instrument = It is not necessary to Cut out the type wheels as they do no harm in being rotated altogether

This particular mode of cutting in and out electrically Can be varied in innumerable ways and I therefore do not wish to Confine myself to that particular way

An Extra magnet not polarized might be used the type wheel Cutting that in and that Cutting in the Ptg Lever

[Witness:] Jos T Murrey

T A Edison

AXS, NjWOE, Lab., Cat. 1174:13 (TAEM 3:13). "on" interlined above. bSignature.

1. This entry is continued in Doc. 217.
2. See U.S. Pat. 126,533.
4. The universal stock printer was often called the "two-wire printer." However, in Doc. 222 Edison sketched an "attachment to the U Stock by which . . . it can be worked on one wire."
5. That is, the wheel with numbers.
6. David Hughes.
7. That is, the cotton instrument (U.S. Pat. 113,034).
8. "53 Wright St. Newark, N.J." appeared at the end of the entry. This was the Edisons' new residence.

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Newark, Jan 4 1872

Since Last writing I have made further improvements in the mechanical lock devices. As now constructed, I shift upon an opened circuit and at the Same positions on all the type wheels, and not on a closed circuit as heretofore described. 2 this makes it more practical and easier for the Transmitting Operator. The Unisons being all in different positions, it follows that if I wish to operate an instrument which says catches on the Letter B I turn around a number of times to ensure the stoppage of the Unison by the type Wheel and Stop the trans-

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mitter pointer at B and close the Printing Lever and release the type wheel then of course the type wheel & the transmitter correspond then I turn them both around until I come to the shifting pegs then close the Ptg Lever unlock the wheel and then transmit my message = In case some one of the Printing Machines did not happen to lock or got out accidentally the type wheel would not correspond with the transmitter so the message would only be a jumble of unreadable letters but be ok on the inst which the message is intended for. I could dispense altogether with shifting and locking of the Ptg Lever as every inst would print a jumble of letters except the inst which it is intended to receive the message but I prefer to lock the Ptg Lever saving paper and as being more seemly & convenient I will state here that over a year ago I suggested to Genl Lefferts Should he wish to work an number of Private telegraph Printing Instruments on one circuit between a firms office & factory Every pair of such instruments might have type wheels to Correspond but every other pair have type wheels similar but the Letters placed in different positions So that no firm on the same Line could read the message of another firm =

The above sketch represent a Printing instrument which has two type Wheels and Prints upon two strips of paper. This is done by one magnet working two printing Levers or a separate magnet to each lever but both in the same circuit and locking one or the other by the shifting device and arms.

An Inventive Flurry
Device for Printing with a number of Printing Levers from one type wheel. A separate wire runs to each Printing magnet and one wire for the type wheel. This type wheel is rotated by a break wheel. 4 transmitters are used in either is a device which other type wheel may be arrested at any desired point by depressing a key, independent of the others in the same circuit. The speed is greatly increased with this device.

Witness by: Jos T Murray

T. A. Edison


1. This entry is a continuation of Doc. 216.
2. This is a reference to actions on the typewheel circuit.
3. Edison later patented two different machines employing two printing levers on one circuit (U.S. Pats. 131,338 and 131,339), but neither was of this design.

Newark, January 5, 1872

EDISON—STILLWELL—Dec. 25th, by the Rev. W. S. Galloway. Mr. THOMAS A. EDISON and Miss [MARY] STILLWELL.

PD (photographic transcript), Newark Daily Advertiser, 5 Jan. 1872, 3.

1. This notice appeared in a section headed "Married."
2. Apparently the newlyweds honeymooned in Boston. No entries in Edison's hand exist in technical or financial records from the date of the wedding to January 1872, and an account entry dated January lists $165.00 "By Cost Trip to Boston" (Cat. 1213:4, Accts. [TAEM 20:7]). About the time of this notice, the Edisons established housekeeping in their new home at 53 Wright St., Newark (see Docs. 206 and 216, n. 8). Account records show that Edison spent about $2,000 furnishing the house, providing for Mary's wardrobe, and employing servants. Prominent among the furnishings was a piano. Cat. 1213:250-52, 400, Accts. (TAEM 20:21-22, 25); Cat. 1185:18, Accts. (TAEM 22:571).
3. No official record of the marriage has been found.
4. W. Smith Galloway was the minister of the Summit, N.J., Methodist-Episcopal Church from 1870 to 1872. Prior to this he had served as minister of the Asbury Methodist Church (renamed the South Market St. Methodist-Episcopal Church), located a few blocks from the Stilwell home on Jefferson St. in Newark. Journal of the Northern New Jersey Conference, United Methodist Church for the years 1870-72; Holbrook's Newark City Directory 1869, 257; 1870, 261; and 1871, 281.
5. Sixteen-year-old Mary Stilwell (1855-1884) had worked for Edison's News Reporting Telegraph Co. in October and November 1871 (see Doc. 205, n. 2). She was the daughter of Nicholas Stilwell, a lawyer and sometime inventor, and his second wife, Margaret Crane Stilwell. Among Mary's many siblings were her older sister Alice and her younger
brother Charles, both of whom retained a close association with the Edisons after Mary's death. U.S. Bureau of the Census 1967c, roll 880; Newark Daily Advertiser, 10 Feb. 1870, 3; Edison, Mary (nee Stilwell), folder, EBC.

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Notebook Entry: Printing Telegraphy

[Newark,] Jany 6th 1872.

This is a double Type wheel having each wheel split in 3 or more Segments and the inner ends pivoted on a set sleeve on the shaft. When the Shifting device is thrown one way the segments of one type regain a complete wheel ready for Printing while the segments of the other are thrown off at an angle thereby making it smaller than the other wheel

Unison Device. Extra ex tooth wheel with a space where there is no teeth. when the Escapement lever is up and circuit open the prong on the Ptg Lever fits the teeth in extra wheel, & no effect is produced & the Ptg takes place as usual. but if we wish to rotate the type wheel to Unison should it be out we close the Escapmnt Lever circuit & bring escapm Lever down in so doing we bring the V teeth of second wheel in such a position that the prong on the Ptg Lever when that is brought up will shove the type wheel around half a Letter Lifting the Escapmt Lever out into half next tooth & when the printing Lever is let down the magnet working escapement which still continues closed brings escapement Lever down again and places teeth of second wheel again in a position to be thrown forward by the printing Lever, & so on until it comes to a place where there is no teeth then it is to unison. then open the Escapement Lever circuit & go ahead on an open circuit in the usual manner, until you wish to catch all

An Inventive Flurry
the instruments at Unison, then close circuit & work Printing Lever until type wheel stops = 2

Arrangement for furnishing “breaks” for a whole line of Printing Instruments from a central Station, by means of my Engine break already described in my Universal Printer Patent and Caveat. This engine is of the same make as described on page 7 of this book but in this case I dispense with breaking the main circuit by the points on the armature Lever of the Little arresting magnet—and I also make the armature Lever arrest the break wheel on the up stroke (ie) when the magnet is open, and not closed as employed in the usual manner. I also include this magnet in the main circuit, so that every time the engine makes two one revolution two breaks are made and of course the arm of the arresting magnet vibrates with it but does not arrest the wheel. Now I provide the Type wheel shafts of the Several instruments with projecting arms which pass in the path of Keys now when a Key is depressed the arm revolving around by the action of the Escapement & magnet which receives its breaks from the Engine break at the Central Station, this arm is made of two springs in contact when revolving and are connected to the main circuit in such a manner that when the arm is arrested by the key the two springs are seperated and the main circuit opened. at the moment that this occurs there is not circuit on the Line it being so adjusted that it will be at the interruption of the Current on the break whenel = Now there being no Current on the Line the armature Lever of the Little arresting magnet Stays up and Catches the break wheel and arrests it, not on an open circuit but just as it commences to close. this insure a full break when the key is raised, for when it is the Circuit is instantly closed the Little Lever is let down or drawn down and the break wheel revolves as before & so on. The Receiving instrument can have a vibrating point & Local battery Connected with the Printing Lever So as to receive any message which may be sent, but I do not use any spring on the
sending instrument, as I wish to dispense with a Local battery although it may be used =

In the instruments and Lock devices adjust explained but one instrument Can be used at a time

But a shifting device might be added which would shift on a closed circuit on the Letter Z and a double unison made This shift might be made to shift and throw one unison out and the other one in the first unison for working a Single inst and the Last to work them all. The last being set on all insts alike the former at various places. Where it is necessary to work both the Letter wheel and Figure wheel I add an extra shifting device for Locking and unlocking =

I will state here that I Lock on the fraction dot open circuit and unlock on the fraction dot closed circuit = on my Lock Instrument =

Witnessed* Samuel Edison* T A Edison

Written at a slant. *Dotted line drawn under signature.

1. See Doc. 212; cf. U.S. Pat. 126,529.
2. Edison patented this unison device (U.S. Pat. 131,344).
3. Doc. 208.

[Newark,] Jany 8 1872

I am requested by General Lefferts to invent a peculiar unison for what is known as the Callahan 3 wire instrument'

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Notebook Entry:
Printing Telegraphy

A is a slide piece which moves very freely through the pad or one side of it and is prevented from turning by the wire D passing between two guide wires F secured to a pillar = Upon this slide is secured two peculiar shaped click B.C. Fig 2 shows one of them to better advantage F F' are two stars wheels secured to the two different sleeves of the type wheels, and these wheels act the same as the unison device shown on
Some of the teeth of the star wheel being cut out at a given position = G G' are pins secured to the W Type wheel sleeves just back of the dots or Zero points = The purpose of these pins is to throw the slide and its clicks eiunder one star wheel or other = Supposing both wheels to stand at zero Then the slide will be in a position where one click is directly underneath the star wheel of one type wheel and the other is thrown out one side.

Now supposing that the Letter wheel was in unison But the fraction wheel was not = Now when the operator starts to rotate the Letter wheel, the pin G will come on the bevel of the click C and throw the Bar A over and bring the click directly underneath the star wheel of the Figure type wheel, which is out of Unison. (Bad drawing, shows both under). Now the first Letter printed the printing Lever comes up = The click B, coming into the star teeth throws the type wheel ahead one Letter and will continue to throw it ahead at every movement of the printing Lever until it comes to where there is no teeth on the star wheel then the type wheel will be at zero. Now as long as you work on the Letter wheel The slide will remain over to the figure wheel side, but if not now the operator brings the Letter wheel to zero, or what or tries to, and it is 2 Letters behind, and commences the rotation of the figure wheel. the first forward movement of the figure wheel by the aid of the pin G' throws the slide over and the click under the star wheel of the Letter wheel and that wheel will be brought to zero by the first two upward movements of the Printing Lever. The whole thing is this B, & clicks is a "Corrector" when one type wheel goes around it throws [---]B & etc under the other for correcting it & vice versa.

I do not wish to confine myself to a star wheel & V shaped click as I can use a ratchet wheel and ordinary click Neither do I wish to confine myself to a sliding bar with Clicks in the Printing Lever as the star or ratchet wheels may be made to slide by the action of the rotation of the type wheel and an arm or other devices secured outside or independent of it =

Another unison device each sleeve being provided with two little teeth slightly Bevel and a pin on the shaft.

January-June 1872
A B are flanges bent slightly at the unison point. F G are carriers for locking the rotating wheel with the wheel to be set = one end of each has a head with a slot in it which works in the flanges A B. When a type wheel is rotated around this carrier is thrown forward but is brought out of the path of the outer carrier between the type wheels by having a portion of the flanges A B bent outward just at the unison point or last one or two letters. It is not necessary to bend the carriers up to the periphery of the type wheels as I have shown = witnessed b Samuel Edison c TA Edison


1. Edward Calahan's stock ticker did not have a unison when it was first designed. Telegraph inventor Henry van Hoevenbergh created one for it in 1871 (U.S. Pat. 120,133). Edison sketched another unison for this machine on 6 March 1872 (Doc. 253).

2. Doc. 219.

Notebook Entry: Automatic Telegraphy

Perforator for Telegraphs

A B C are levers. I use nine of them. They are worked loose on the shaft X which is its fulcrum. These levers are
made of \( \frac{1}{8} \) inch sheet steel and very broad so as to give them the required strength. One is placed inside of the other, and the whole are placed immediately under a bank of keys. In practice I obtain the selection of any bar-Lever by making tits or teeth on the keys. Thus

Or these teeth knobs or projections on the keys may be thus

or they may be dispensed with altogether on the keys and the teeth made on the bars or Levers or notches may be cut in the Levers. Thus

Fig 3

or this way
some trouble may be anticipated by the springing\(^1\) of the Levers but this can be obviated by connecting a strengthening Lever as in Fig 3 from A to B. Or the Levers can be made in this manner.

Each square swinging separately or it can be made in this form.

This form of Lever is probably better than the ones heretofore described owing to the strength of the Levers.

The paper feed device which I intend to use in this machine is peculiar. The motive power being derived from a spring or weight or any outside power not derived from the pressure on the keys =

Theis Length of The paper feed is controlled by the Levers or by the keys.

End view.
ADDENDUM

[Newark, c. January 13, 1872]

Perforator = I do not wish to confine myself to a die and punches, for I believe they could be dispensed with and cutting punches hollowed out, and cutting on a hard raw hide surface, be substituted with advantage. When

Should my paper device prove to be badly arranged in an upright position, the Die may be Set flat ways instead of edge-ways as heretofore Shown Thus

The flat bars may be dispensed with and the several round bars substituted Thus
New movement for perforator

AXS, NjWOE, Lab., Cat. 1181:9 (*AEM 3:178). *Date taken from text.
*Interlined above. *Signature. *Addendum is an AX. *Followed by “over”
to indicate a page turn.
1. "Springing" means bending sideways under pressure.

2. This addition immediately follows Doc. 221. It was probably written soon afterward, but could have been written as late as the end of January, for the next entry in this notebook (Doc. 240) is dated 1 February 1872.

[Newark,] Jany 13 1872 =

Universal Machine = Instead of using the two arms and Connecting springs upon the type wheel shaft and being in the path of the [-]keys The connecting points for closing The Little Magnet in the Pulsator may be dispensed with and straight arms only used. When this is done I put a wheel having 30 fine points of Contact insulated between & Connected so as to revolve with the type wheel shaft. rubbing on this wheel is a spring connected to the pulsator Magnet so that by depressing a key the plain arms suddenly arrest the Type wheel and the contact spring, just comes on a contact point of the tooth wheel, and the pulsator wheel is arrested by the little magnet. The type wheel shaft being arrested just a little way from its limit the key being raised will allow it to reach its entire limit rotating the type W Shaft a little & severing the contact points. On account of the Speed with which this wheel is rotated, the spring though touching a point every letter does it so quick that it has no effect on the little magnet of the pulsator, but only when arrested for a small period of time — It is not necessary to use a contact wheel with 30 points and a rubbing Spring. A single spring secured to the shaft of the Escapement lever might be extended out some distance and made to Close against a point just as the Escapement lever was nearly home on an open circuit.
Improved method of catching or arresting the little break on the Engine\(^3\) in my Universal Printer, heretofore I have arrested it first by a movement derived from the arresting of the pin on the type wheel shaft, and the movement of that shaft. Secondly by closing a secondary circuit by arresting a point on the type wheel and closing a magnet the armature of this magnet arresting the break wheel. Thirdly The manner which which I describe on page 26,\(^4\) and Lastly the above. The arresting of the break wheel in this case is done by the direct action of the Escapement lever, the movement having nothing to do with the type wheel shaft that only being used as a means of stopping the Escapement lever at certain points by the action of the points on the shaft going in the path of the Keys and by the aid of the ratchet or Star wheel.

It will be seen by referring to the drawing that a lever is connected to the Escapement lever and that the End of this lever is in or out of the path of the Escap little pin on the break wheel according to the position of the Escapement lever — When the Engine is running at every half turn of the break wheel the magnet operating the Escapement lever is closed consequently the lever P. is thrown into the path of the pin on the break wheel and would arreste it, but the break is so arranged that just as the pin is in the act of being arrested the current of the Escap Lever Magnet is interrupted by the break and the Escapmt lever flies back by the action of the spiral spring and throws the arresting lever P out just in time to prevent catching on the pin and the circuit is again immediately closed the lever is thrown in then jerked out every time the type wheel advances one letter, if used on Double ekt open & close every consequently the break is not interrupted but if we close a key the pin on the type wheel shaft comes in Contact with it, the Escapement lever is arrested half way while and the lever P held in the path of the pin on the break wheel and the break wheel is arrested. now when the key is raised the [-]Escapmt lever is allowed to go its full incirsion the lever P is drawn out and the break wheel revolves as before I do not wish to confine myself to any particular lever, but claim arresting a break wheel by a movement from the Escapement lever or any device attached to the Escpmt Magnet and holding the lever in the path of the type Break wheel by arresting pin or pins on the type wheel shaft by key or other devices. I Could used a seperate magnet to arrest this break wheel and place it in the main circuit and put a break point on the Escapement lever and arrest half way
Thereby opening this Extra Magnet and arresting the break wheel or put a wheel having 30 contact points on the type wheel shaft, and arrest the wheel by the keys & pins in such a position that the break main circuit would be open

Thus first

Secondly

I will mention here that the friction cloth and Spring used on the Engine shaft for friction to carry around the Little break wheel might be dispensed with, and a clutch or click used the clutch being thrown out by the action of the arresting Lever. This click or clutch would be provided with a stop so after the click had been thrown out a short distance it would come against a stop and the wheel would be arrested. one form I here show
A is a milled wheel secured to the revolving shaft. C the click, X the Bk wheel, D the arresting lever, S a Limiting pin.

When the lever is not in the path of the break wheel pin the click is drawn to the face of the Milled Wheel by a spiral or flat spring thereby locking the break wheel to the revolving shaft. Now if the lever D is depressed the point comes on the click, this immediately is thrown out and the Limiting pin S stops the click from going out further and the wheel is stopped.

Another form

Attachment to the Universal Stock by which with the aid of a Local it can be worked on one wire, or can be worked without a Local.

Fig 1
The points X are adjusted so that when the Escpmt lever has reached nearly the whole length of its play the contact point just touch. now when the Escapement is rotated rapidly the printing lever does not respond— In Fig 1 the Escpmt stops on an open ckt in Fig 2 on a closed circuit.

Witness Samuel Edison

AXS, NJWOE, Lab., Cat. 1174:23 (TAEM 3:18). bInterlined above.

1. This entry is continued in Doc. 223.
2. For elucidation of these terms, see the schematic diagram in Doc. 193, n. 2. The “connecting points” (or “springs”) here correspond to the contacts on arms D and D’ in that diagram; the “Little Magnet” corresponds to MM’.
3. The “little break” was the pulsator, the small breakwheel that transmitted impulses in the typewheel circuit. The “engine” was the electric motor that drove the pulsator and typewheel shaft.
4. See the next three drawings in this document.

Notebook Entry: Printing Telegraph

[Newark,] Jan 13 1872

I wish it understood here that I can easily combine my Pulsator and arresting devices now used in my universal machine, to any form of Printing Telegraph (ie) attach it or to any mechanism operated by step and step motion or escapemt, Ratchet Motor, or release escpmt & weight or other power or I can combine it in the form of a transmitter only² in many different ways dispensing with the type wheel Ptg lever & printing devices.

I mention here, that I can gear up directly from the engine,² and on the last gear wheel shaft² put a pin or arm or detent revolving in the path of keys, and connect this arm with a V shaped wheel working an arresting lever connected so as to arrest the break wheel on the main Shaft of the Engine, this
wheel being carried around by friction. Thus making a Transmitter. The Universal as it is now operated can by insulating the arrester & platinizing the point on the break wheel be made to close a secondary circuit thus enabling to work instruments which use two wires. The geared transmitter I show thus=

Witnessed Samuel Edison

T A Edison


1. This entry is a continuation of Doc. 222 and is continued in Doc. 224.
2. See Doc. 211.
3. See Doc. 251.

[Newark,] Jany 13 1872.

It is of course obvious that my Universal Could be Operated upon an open & closed circuit (ie) by opening the Circuit advance the type wheel one letter and by closing advance another letter, but I prefer to use both opening & closed to move a letter it being in my opinion More practical =

The pins on the shaft of the Universal type wheel spring a little and might be made in this way
Instead of

I claim a dead motion or the use of a dead motion in a Star or wedge acting escapement for the purpose of giving the printing lever time to get away from the type wheel before it starts & not blurring the letter. I believing myself the first one who discovered or used this method, other parties, (Phelps & Grey & Barton) using devices for throwing their printing levers to the type wheel & then quickly back they not knowing they are wholly unnecessary providing there is a slight dead motion in their Escapement which there generally is.

I claim the use of paper in a single wheel Machine of an inch or more wide, when such paper is used with my paper driving devices, or in other words I have found that 1/2 or less paper cannot be driven or worked practically in a printing Telegraph which is operated by inexperienced persons.

I do not wish to confine myself to any particular form of Electric Engine in my universal, nor even to an Electric Engine as the break wheel may be driven with gearing or any other device operated by any force. Or the revolving wheel can be dispensed with and a Vibrating lever used, operated by a local and this self Vibrator opening & closing the Main Circuit and the arrester used same as that for arresting break wheel heretofore described and this arrester made to stop The Vibrating Lever or to open its circuit by a Contact point. Or the breaks may be furnished by a clock movement or any other devices, and the arrester made to act electrically (ie) open & close the Main circuit so that when arrested in a certain position it will open the Main circuit & prevent any more breaks from being sent over the wire & when released allow the breaks to be sent. In fact a point connected to the Escapement Lever of any printing Telegraph can be made to Control the devices which furnishes breaks by arresting it in certain points of its motion as well as to control the printing lever—

Witness Samuel Edison

T A Edison

January–June 1872
Elisha Gray's private-line printer.

Notebook Entry: Printing Telegraphy

[Newark,] December 15 1872

I do not wish to confine myself to any particular method of arresting the break on my Universal. I can be done this way.

X and H are vibrating points work so quick don't allow current in arresting magnet Long enough to close lever but when key depressed and shaft arrested Escapement lever closes points X & H allows Current to circulate through M long enough to bring armature down and arrested the break wheel.

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1. This entry is a continuation of Doc. 223.
2. See Doc. 195 headnote.
3. "Dead motion" is the initial part of the travel of the escapement lever, before the lever engages the typewheel ratchet and consequently before the typewheel moves.
4. George Phelps had developed two private-line printers (U.S. Pat. 110,675 and 126,329) for Western Union; both had jointed printing levers.
5. Elisha Gray, Enos Barton, and Western Union division superintendent Anson Stager had recently formed the firm of Gray and Barton in Chicago to manufacture telegraphic and other electrical apparatus. Later in the year they formed the Western Electric Manufacturing Co., with Western Union holding a one-third interest in the firm. Western Union also sold its manufacturing shop in Ottawa, Ill., to Western Electric, which became the largest manufacturer of Western Union's instruments. The company's products included Gray's private-line printer (U.S. Pat. 132,907), also known as the Gray and Barton printer. Although U.S. Patents 126,329 (see n. 4) and 132,907 would not issue until later in 1872, it is evident from this entry that the instruments described in those patents were already in use. Lovette 1944–45, 274; "The Story of the Western Electric Company," Western Electric News 1 (1912): 1–2.
6. Edison had devised such a lever himself. See Doc. 193.
LK is the shaft with point arrested by keys C. A break wheel with block points made of insulating substance. B a spring. The pointer on the shaft is placed in such a position that when arrested the point B will be on one of the insulated parts of the wheel A. The insulated points always passing under the spring B when the main circuit is broken by the break wheel consequently the breaking of the main circuit by the wheel A & spring B does not affect the regular pulsations. Now the magnet G being in the main circuit every ha it vibrates its armature & arrester the same as the escapement The arresting lever going in & out between the pin on the break wheel twice every revolution or as many times as there is breaks on the wheel but does not arrest it. but if now a Key is depressed the break wheel A is arrested and the circuit is broken and the arrester is thrown or rather is not drawn down and the break wheel is arrested on a closed circuit but the circuit remains broken at B & A if the key is raised the escapement advances slight distance which the key prevented and the circuit is closed the arrested lever is drawn down and the instrument goes on until arrested by another key being depressed. The wheel A & spring B might be dispensed with and it under patent break substituted by putting it on the escapement and so connecting it that when the escapmt lever is drawn to the magnet the circuit will be closed but when it goes back it will be broken I can use any devices to do this several of these devices were described in a former caveat relating to Vibrating devices which at the time I intended to use on my Universal instead of the Engine.

Witnessed Jos T Murrey

T A Edison


January--June 1872

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Notebook Entry: District Telegraphy

1. Probably should be "Unger's"; see Doc. 237, n. 2.
2. Edison used this idea (I in the drawing) in his redesigned universal private-line printer (Doc. 262).

[Newark,] Jany 15 1872

The object of this invention is to communicate different signals automatically from a number of machines on one circuit and to record & indicate such signals at a central point. The signalling machines being placed in private houses etc all a number on one circuit connected to a Central station, and are to be used for instantly summoning the police or a messenger.²

The invention consists in a several combinations of Mechanism to effect the object automatically. The Combinations that can be made to perform this operation are so various, & unlike, and that to protect myself I shall describe a large number of ways in which the result may be obtained.

K is a shaft  S is a gear wheel  T a pinion wheel with a fan R on it  This fan being used to regulate the speed of the shaft K  L is a loose gear wheel carried around by the milled wheel M & click n by the rack .O. This rack deriving its power from the weight .P. This weight being thrown up by the
finger Q is the handle by which this weight is lifted. This handle movement is limited by two Limiting pins. It is obvious that if the weight is raised to its full height, the shaft K will remain stationary while it is being raised owing to the position of the click n and when it is allowed to descend it will commence to rotate the shaft K with a certain speed governed by the fan R.

On the end of this shaft K is a double break wheel A with a reversible contact point C secured to the hard rubber stud B. The point being limited by the pins d & e. One of these wheels is provided with characters which will open & close the circuit in a manner to indicate "Police" at Central station & also the number of the house. The other wheel will indicate "Messenger" after the same manner. When it is desired to Call police the contact point is thrown over on one wheel and the weight raised, in descending it rotates the shaft K once thus giving the signal. H is a key connected on the main Line. G is a test magnet when you are about to give a signal the key is depressed and the main circuit allowed to circulate through the magnet G which if it remains closed for a small length of time shows that no other signal is being sent. When the Key is raised the magnet cut out and the weight raised and in descending the Signal is rec transmitted.

I do not wish to confine myself to a fan for regulating the speed of the shaft K. or the descent of the weight. As it can be done by air thus:

B the weight A. a very tight air cylinder with a piston within it. The piston connecting to the rack & weight. When the weight is raised sufficient extra power is applied to force the air out through the small hole X. but when descending the power of the weight can only force it out slowly and consequently it falls slowly.

The weight might be dispensed with an a spring Substituted thus.
The rack break wheel and its parts might be dispensed with and the same thing accomplished in this Way. Thus:

A is a cylinder with a rod D having a head B in this cylinder. E is a knob or handle & serves both the purpose of raising the Rod D and as a weight to force the air out of the cylinder as the piston head descends. G is a contact spring rubbing on either side of the Signal Bar F as the case may be. This when it is desired to give the signal upon the circuit the Rod D is raised to its full height and the spring G rubbing on either side of the signal Bar or Contact piece F makes & breaks the circuit as the rod slowly descends as it will owing to the force necessary to expel the air quickly being greater than the effect of the weight of the rod & the knob E.

The Contact may be made in this manner.
The downward movement of the piston rod moving the Contact wheel a short distant around, four or five signals being made on one revolution, and one full signal being upon the segment of the Circle moved—

The air cylinder may be made to regulate the speed of a shaft which may derive its power from any source. The object mainly being to dispense with as many gear wheels as possible or with them entirely. The manner of regulating is thus:

The air cylinder might be dispensed with and a spring attached, or a ball might be attached to the end of the Vibrating lever .C. The form of the teeth which gives motion to this lever can be made in a ratchet form or star, or waving former. The ratchet wheel and Vibrating arm might be dispensed with by making it in a governor in this form.

F is the shaft. G H are two small pulleys a is a cord worked by the lever D. B is a spiral from which the power is derived. This spring is provided with a cord where it goes on the pulley H, it being on top and wound in opposite to that on G.

C is a weight which is used to regulate the rotation of the shaft. E. When in its normal position the lever D is at the point W, but when a signal is to be given by the rotation of the break.
wheel the lever is pulled over by the hand f to Y and this act stores u winds up the spring but does no turn the shaft on account of a click which prevents it going backwards. The act of moving this lever by the hand stores up the power in the weight and when the lever is let free by the hands the shaft commences to turn slowly according to the distance of the weight.

There is still another mode of governing the rotation of this shaft, without gears. Thus

![Diagram of mechanism]

A is a drum upon which is a handle B which is secured to the shaft X. Q is a small pulley on which the cord of the power spg G is secured. N are the two break wheels carried around by friction on the shaft X by a spring washer & cloth at E. C is a governing fan connected with the drum A by a cord.

By turning the handle B from Z to O. The spring is wound up and when the handle is free the shaft commences to turn but cannot go fast as the fan an large size of the wheel A prevents it.

A single gear and flat spring might be used in the following Manner.

![Diagram of mechanism]
This is another form in which a governor which can be not very necessary, or slight—

X is a screw C a traveller N the break piece when the drum in wound up the shaft or screw revolves very quickly and the traveller goes over to the other end making the breaks on N when it gets over, it throws a little wire up which throws it out of the thread and is drawn back home on this wire by a spiral spring—
a is a rod of insulating material with the characters sunk in on each side. B & C are the contact springs, d is a spring which rubs on the side of E and through which the circuit is conducted from E to the square X. K is a handle pivoted on X and has two limiting and has a limiting pin to prevent it from falling. G is a pinion having a fan H secured to a slide F, and is thrown out of the rack E when the handle K is lifted in the act of raising X to the top of A from the bottom and is thrown back in the rack by the spring J when the handle is released. Then the block X gradually drops to the bottom with a speed governed by the size of the fans H H'. The contact spring B or C making a signal by coming in contact with the side of a. The side which shall act being governed by the electric switch L M N, N being the button connected to aX and through with the line and CL to one side of a & M to the other.
About Signaling Machine
Witnessed Samuel Edison

* Followed by "over" to indicate a page turn. *Signature.

1. This entry is continued in Doc. 228.

2. Telegraph devices had been used in municipal fire alarm systems in American cities since 1852. In 1871 Edward Calahan invented a "district and fire-alarm telegraph" to give "warning in case of fires, burglars, or accidents" (U.S. Pat. 127,844, p. 1). Together with some Gold and Stock Co. associates, Calahan incorporated the American District Telegraph Co. (forerunner of the present ADT Co.). The company established offices in several Brooklyn and New York City neighborhoods and placed small, simple transmitting devices in private homes in the surrounding areas. Messenger boys stationed at the offices responded to subscribers' signals for police, firemen, the family doctor, or messenger service. The company grew from an initial group of 4 subscribers to over 2,000 within two years. In 1874 Edison and several others organized a competing service, the Domestic Telegraph Co., which exploited Edison's U.S. Pat. 154,788. Reid 1879, 634-36.

3. This was a feature of Calahan's device as well.

[Newark.] Jany 16 1872.

Notebook Entry: Automatic Telegraphy

I claim two pens for receiving chemically which shall be connected together electrically, one pen I put about the one hundredth of an inch ahead of the other in the same line. The object of this is to reduce the resistance of the paper and make a double decomposition, as the resistance of the paper is reduced one half by having two points it follows that very near as much current will pass through each of the two points as one as twice as much current will be taken from the battery. now one pen passing over the paper will leave a mark of a certain intensity and another pen passing over the same mark will increase its intensity.

It is not necessary to have them one before the other for they may be placed side by side very close so that one pen shall make a very fine mark and the other will double its size so as to make it legible.
Another Idea. In a iron solution (ie) prussiate of potash or other solution with which an iron pen is used to decompose and in which there is considerable acid, and excess of acid may be used so that when no current is passing the acid will attack the pen and produce a mark but when the current is passed through the pen & paper it will prevent the acid from attacking it or prevent the mark whatever it may be caused by. by this means the resistance of the paper may be materially reduced on account of the possibility of using an excess of acid =

To produce this effect it would be necessary to arrange the Transmitting & Receiving Machines in this Manner

I will now illustrate and describe several methods of arranging the electrical Connections and batteries for sending and Receiving =

In this Case The Local is used to decompose The Chemical paper and the Main battery X to neutralize its effect, by means of the perforated paper— R is the resistance Coil for adjusting The Local so that the battery X will exactly neutralize it
In this Case the Current or rather circuit is not broken but the battery is cut in & out by The perforated paper & pen. This Can be used with a local

or with an induction coil the circuit not decomposing direct but acting in the see primary coil induces sufficient current in the secondary to decompose

or the induction coil may be used thus

straight =
2 Resistance boxes adjusted so as to split the Current.

Local which decomposes and main Line battery which also decomposed R coil in Local circuit to prevent the Local from making too plain a mark. The use of this Local is to electrolyze the atom of chemical solution to a point where a slight increase would decompose it which is done by the Main

Poles opposite. Main Line decomposing Local neutralizing. Excess of main over Local produces mark when it ceases Local cuts the mark short

fine wheel teeth wheel pen for receiving on chemical paper.
Wheel recording device on chemical paper, with a brush to keep it clean
Witnessed Jos T Murrey\(^c\) T A Edison Invnt


1. Potassium cyanide (KCN).

---228---

Notebook Entry:
District Telegraphy\(^1\)

Here is quite a novel and simple arrangement for performing The arrangement operation\(^3\)

X is a cylinder \(B\) a plunger with a rack \(G\) on it working in small gear wheel \(K\) on main shaft \(I\) which has break wheels \(H\) same as described before. \(^4\) \(Q\) is a spiral to pull the rack back when at rest the signals where be provided with devices for carrying only one way \(L\) is an arm to which the cylinder \(X\) is fastened this arm swings on the Main shaft \(M\) is a small cylinder in which the mercury runs when the cylinder is tipped up as shown. Now if we wish to rotate the signal wheels & shaft we take hold of the handle \(E\) and let the two cylinders drop by gravity so they stand upright. the moment they do so the mercury from the small cylinder runs into

January–June 1872

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slowly into The Large cylinder, (the rapidity with which it runs being governed by a Taper screw .V) and acting on the head of the rack plunger slowly raises it and rotates the shaft and break wheels one revolution. Now by returning the cylinder to the position shown in the Drawing the mercury runs by ready for the next signal.

I obtain another slow motion of the shaft carrying the break wheels by putting a fan on it and running this fan in a tube filled with Metallic Mercury.

X is the tube filled with Mercury.

I shall now describe the means of indicating the signals sent and recording the same in the Central office.

As all of the break wheels must necessarily stop on a closed circuit [-] to bring out the signals properly upon an ordinary Morse register a slight alteration is necessary.

The break wheel to give the signal 1 2 5 is made in this manner one break for 1 two breaks for 2 and five breaks for 5 and then the wheel stops on a closed circuit N The signal to be plain should come from the Register in this form

This is done after the following manner

*An Inventive Flurry*
The magnet X of the register has a double set of helices, through one of which the Local passes constantly and through the other the main. Now when both are closed they neutralize each other, and no mark is made on the paper, but when the break wheel of any machine is started every time an opening occurs the main line current ceases in one of the bobbins for an instant and the Local acting brings the Lever up and indents a dot. When two breaks follow quickly 2 dots & so on.

The dots may be recorded in this manner by polarizing the magnet in such a manner that when the main line current circulates through it, it neutralizes the effect of the polarization for the time being but when interrupted for an instant the polarization of the magnet is sufficient to indent a mark upon the paper.

I do not wish to confine myself to a particular Machine for recording in this manner. As an Ink recording Machine could be used or Chemical paper etc.

It can also be printed out. I do this in following manner. 

1. This entry is a continuation of Doc. 226.
2. This entry is clearly preliminary to Doc. 229 (17 January), which duplicates some parts of it and refines others; see also n. 1.
3. The devices illustrated here are district telegraph apparatus.
5. No drawing follows.

[New York,] January 17, 1872*

I, Thomas A. Edison of Newark, N.J. do hereby declare the following to be a full description of Impts. in District and Alarm Telegraphs as far as perfected.

The object of this invention is to communicate different signals, automatically, from a number of machines placed in
one circuit and to record the same at a central point, or station. The machines are to be placed in private houses, and are to be used for summoning the police, messenger, though applicable for other purposes.

The invention consists, in a peculiar combination of mechanical devices for transmitting the signal automatically, and a Recording machine for recording these signals at the central station.

The mechanical combinations which would perform this operation are so various that to protect Myself, and to further an enterprise now being carried on, with benefit to the public, I shall describe in this caveat, as many such combinations, which I believe to be my invention.

Fig. A.

In Fig. A. G is the main shaft; S is the double signaling wheel or "break" having a click upon its side (x). Q is a ratchet wheel, secured to the shaft G, into which the carrying pawl v lays. This allows the shaft G to carry the break wheel forward but not backward. A second ratchet wheel secured to the break wheel is between Q and S, into which the pawl R liesays, the use of which is to prevent the break wheel S from going backwards when the spring M is being wound up.

F is the contact spring pivoted on the platen B, one end resting on the break wheel S and the other end having a handle, whose object is to throw the contact spring from one side of the signaling wheel to the other, so that different signals may be made.

P is a small pulley over which the cord O runs, M is the spring, which may be either spiral or flat or in fact any shape, and is used to store up the power derived from the hand in the act of moving the handle K from the dotted Lines to the upright position.
T is the weight secured to an arm from K by the screw H, and is adjustable so as to allow of an increase or decrease in the speed with which the shaft G is driven.

Operation.

When a signal is to be given, the contact point F.E is thrown over to either one side or the other, according to the signal to be used. Then the handle K is moved by the hand from the dotted lines to its normal position. In thus moving it, sufficient power is stored up in the spring M to give the shaft G and break wheel one revolution which is sufficient to send the signal. It will be seen that the spring M must raise the weight T and arm and restore them to the places shown by the dotted line and this makes the revolution of the shaft G quite slow =

The ratchet wheel on the break wheel and on the shaft might be dispensed with and the signal or break wheels secured to the shaft, and a pin put in the shaft, which would be arrested by another pin fastened to a lever, as in figure .2.

Fig .2.

and when in the act of winding up the spring M, the cord would slip over the pulley .p. and not rotate the shaft, or the pulley itself might be provided with a ratchet and pawl, which would carry the shaft forward but not backward.

I do not wish to confine myself to any particular mode of governing the speed of the main shaft as I shall explain several ways in which that object can be obtained attained.

Fig. B'd

The mechanism in this machine Fig. B' is similar to that described in Figure A, with the exception of the governor, which consists of an air cylinder A within which is a plunger.
B secured to the lever c by the rod D and set screw. The rod c is provided with two prongs placed in the path of the V shaped tooth wheel M secured to the main shaft, when the power is applied to rotate the main shaft up and down motion is communicated to the lever c and piston or plunger B, and as this plunger head has considerable area it retard the revolution of the main shaft. The plunger if moved slowly expels the air quite easy and takes but little power to move it but when the attempt is made to work it up and down rapidly, the power required is greatly increased.

The air principle might be applied directly Thus:—

Fig. C.

D is the air cylinder, c the head B the plunger rod A the handle and weight F a fine tooth ratchet or milled wheel H an arm moving loose on the shaft W and connected to B by the a h pin & slot G is a pawl laying on the ratchet wheel E is the break wheel, divided in four segments each one containing the complete Signal. Now when the plunger Bc is raised by the hand and the shaft W released by the arm U The weight A acting by gravity forces the plunger down slowly and the break wheel is rotated a quarter of its circumference which is sufficient to give the required signal.

I do not wish to confine myself to a weight as a spring, magnet or other power may be applied to force the piston down or up as the case may be.

Neither do I wish to confine myself to that form of break as it can be made thus Fig. D.
A and B being cogged wheels and raising and lowering the rods c D and making and breaking the current on the points E.F. the signal being selected by the electrical switch G and points H and K and the wires.

Another form of break may be used. In Fig. E The wheel A Behaving an irregular groove corresponding to the signal to be sent and within this groove is a pin connected to an upright lever B C is a connecting point. when the wheel A is revolved a peculiar motion is given to the upright B, which closes and opens the circuit at the point C as many times as the groove in A is thrown out of Line.

Fig. F is another form of break A is a pillar of insulating substance with the signaling character sunk in this substance
and all connected together with the Line. C is the contact Lever with springy point H. This lever is pivoted at G. E is a cam wheel revolving with the shaft F. D is a pin rubbing on the periphery of E. At every revolution of the wheel E and shaft F the rod C is carried down by the wheel and up by the spring B, the whole length of the pillar A in going up the spring H rubbing on the contact points of the pillar A transmits the signal but in coming down is prevented from opening the circuit by the wheel N and spring M which closes the circuit when coming down but allows it to break going up by a piece of insulating substance forming part of the wheel.

The pillar might have two sets of teeth set in the same line but one set connect with a strip of metal, and the other the same way, and a switch could be used to select or determine which signal is to be used

Fig. G

A disk might be used which would swing on a pivot and a handle used to select the signal to be transmitted as in Fig. G.

There are several modes or devices by which the signals can be selected, one of which is to shift the break wheels, so as to bring one wheel or the other under the same point.

Another way is to have both wheels loose on the main shaft and throw a clutch from the shaft to the wheel when a signal is to be sent and arresting it at zero and throwing the clutch in an the other wheel and so on.

Or One single wheel can be used, two disks interlocking each other band separated by a disk of hard rubber, and one spring used. either disked could be switched in or out by a switch, or changer

The machine might have a paper carrying drum, instead of the break wheel, and perf the signal or in fact a great many signals previously prepared might be selected and run through the machine.

An Inventive Flurry
Or if only two signals were to be used the two strips of perforated paper could be pasted on a smooth wheel and the breaks made through the paper.

I will now describe another novel device for obtaining the slow motion necessary without the use of a number of gear wheels.

Fig. H.

In Fig H. \(X\) is a cylinder in which is a plunger \(D\) with rod \(B\) on the end of which is a rack working in the gear wheel \(G\) on the main shaft \(H\). \(K\) are the double break wheels. \(L M\) the contact spring. The cylinder \(X\) swings on the main shaft \(H\) by the lever \(N\). \(A\) is a handle used for raising the two cylinders to the peg \(P\). \(E\) is a reservoir of metallic mercury connected by a spout \(F\) which also holds the two cylinders together. The reservoir is nearly filled with mercury and is higher up than the other cylinder. Now when the two cylinders are in the position shown the mercury runs through the pipe \(F\) into the reservoir \(E\) and entirely out of \(X\) and the spiral spring \(R\) draws the plunger \(D\) down nearly to the mouth of the spout \(F\). If now it is desired to give a signal the handle \(A\) is lifted off of the peg \(P\) and the two cylinders allowed to drop by gravity. The moment this takes place the mercury runs out through \(F\) into \(X\) under the ehead \(D\) and the rack is raised slowly, and giving the main shaft \(H\) one revolution, its slowness being regulated by the size of the hole through the tube \(F\). When the signal has been given the handle \(A\) is brought back to \(P\) by the hand and the mercury runs back into the reservoir, ready for another signal. I do not wish to confine myself to any particular devices for getting this slow motion from mercury, for this purpose, but claim the use of mercury falling by gravity from one re-
sevoir to another and acting on a head to give motion—the flow of the mercury being regulated either by a cock in the tubes or by a greatly increased area of the piston head operated upon.

Another plant to get a slow motion or rather a device for governing the speed of the main shaft is to connect several paddles or leaves of metal to the main shaft and work them quite deeply in a small cylinder of mercury—Thus. Fig. I.\textsuperscript{a} Fig. I.\textsuperscript{a}

A is a sealed glass tube containing the main shaft and fan B. and filled nearly full with mercury. When the handle X is pulled down, and the spring wound up, the main shaft will revolve very slowly by reason of the immense resistance of the mercury—

I will mention here that in some cases it will be impracticable to open and close the main circuit to transmit a signal to the central office but the signal can be sent at the same time preserve the continuity of the line intact—Thus. Fig. J.\textsuperscript{a} Fig. J.\textsuperscript{a}
The first figure J shows the continuity perfect. The second figures K shows the continuity perfect but the current sufficiently weakened by passing through the resistance bobbin to produce an effect at the Central Station, consequently when the wheel A' is rotated the strength of the current will be increased & decreased as the teeth of the wheel A' passes under the contact spring B'.

I shall now describe the devices by which I intend to record the signals. The first device is a common Morse register, as the break wheels must always stop on a closed circuit the characters would be difficult to read if received in the ordinary manner. Now to signal 1 2 5. the break wheel is constructed thus Fig. L.

One opening for 1, two openings for two and five openings for 5. This would be received upon the register thus Fig. M.

Now this is quite perplexing to read and very liable to error.
When the following device is used the signal shows on the strip thus fig. N.

Fig. N.

Fig. O.

The magnet X of the register Fig. O. has a double core helix or bobbins, the Local C passing through A and the main Line through B. Now when both are closed they neutralize each other and no mark is made, but when a break occurs in the wheel, the equilibrium is destroyed and the Local battery acting on the magnet draws the lever up and indents the paper, and when two breaks occur close to-gether two short dots are made and so on. I do not confine myself to using a local, as the extra bobbin and local may be dispensed with and a permanent magnet substituted (ie) the magnet AX polarized in such a manner that when the main circuit is closed they will neutralize each other, and no effect be produced but when a break occurs in the main line, the permanent magnetism will be sufficient to indent the paper.

An ink recorder may be used in this manner or AChemical paper. I do not wish to confine myself to any particular method of marking, but claim the manner of recording the "breaks" instead of the closure as is usual.

A relay may be used with a local thus fig. P.
The back point of the relay closing the local through the register.

Signed by me this 17th day of Jan. AD 1872

T A. Edison

Witnesses: Geo. T. Pinckney, Chas H Smith

ADS, DNA, RG-241, Edison Caveats 37. Petition and oath omitted.

Date taken from text, form altered. Interlined above. "1... perfected." written by Charles Smith. "Fig.", "fig.", or "fig.", and letter designation written in an unknown hand. "In Fig." and letter designation interlined above in an unknown hand. "Fig." and letter designation interlined above in an unknown hand. Written in an unknown hand. Interlined above in an unknown hand. "Signed... 1872" written by Pinckney. Written by Pinckney. Signature.

1. Although Daniel Craig had been pushing Edison's work on the district (domestic) telegraph in 1871 (see Docs. 143, 200, and 203), Edison assigned rights to this caveat on the day of its execution to Elisha Andrews and Horace Hotchkiss, reserving for himself the rights for "business and commercial telegraphing and electro-mechanical purposes." Andrews and Hotchkiss were officers of the American District Telegraph Co. (see Doc. 226, n. 1) and immediately signed their rights over to the company (Digest Pat. E-2:192). Lemuel Serrell, Edison's patent attorney, renewed this caveat twice (Serrell to Commissioner of Patents, 14 June 1873 and 24 Mar. 1874, Edison Caveats 37, DNA).

2. Much of the text of this caveat was taken from the laboratory notebook entries for 15 and 16 January (Docs. 226 and 228). Employees of Serrell's New York office edited the text and witnessed Edison's signature.
Notebook Entry:  
Printing Telegraphy

Two Loose Type wheels clutches a B c d connected together by two arms running in slots planed in the shaft. Type wheels are provided with two holes into either the clutch. Can be thrown by the shifting devices. H is an arm with a V cut in it underneath on the Ptg lever is an arm K which goes in this V in H. The same is on the other wheel. F F' is a retarding spring. G etc is a pin from type wheel to hold it in position when it is unlocked or not carried around. The Operation is simple. If one wheel is locked by shifting the other wheel will stand one letter from zero but the arm K on the printing lever then acting in H camms the type wheel one notch to zero in the act of unlocking and the type wheel which is thus unlocked and cammed forward is prevent from wiggling ahead by the spring F & pin G, but when this wheel is again locked, the force of the Magnet is plenty to overcome the spring F and the type wheel is rotated.

Witnessed = Jos T Murrey  
T A Edison


1. This entry is a continuation of Doc. 225 and is continued in Doc. 232.
2. In a design submitted in a patent application on 28 May 1872 (U.S.)
Pat. 131,341), Edison used a variant of the arms K and H to shift a single typewheel alternately to letters or numbers.

A Chemical printing Telegraph.
This is a novel affair.

X is a bunch of flat platina wirers secured to insulating substance and Each wire insulated from its neighbor—and the Ends brought down on the platina faced drum B very close so close that but a thickness of a peice of tissue paper seperates any of them they make a solid mass about \(\frac{1}{8}\) of an inch square =

The chemically prepared paper passes between this brush square X and the drum RB. This drum is fed ahead after evey letter is made by the keys coming in connection with the rod H This throwing the battery D through the magnet M as will be seen by the wires.

Now beneath the bank of keys are twenty five rods or as many rods as there are platina points in the pen square .X. Each one of these bars being connected to a platina pen forming the brush The bottom part of the lever or keys having tits or teeth on and these teeth are so arranged that they will connect the battery D through a given number of rods necessary to form a letter to the points in X and the current will pass down these selected points Through the chemically prepared paper to the drum thence to the battery D leaving a blue or other colored mark at each Point For instance the letter H would be thus
The first row of points would all mark & leave (a) The second one dot of c the 3rd another dot of c the 4th another do & the fifth row all the marks

The End view of the square is thus

ain practice it is possible to place them much closer than this it will be easily seen that certain points Can be selected to given an letter figure & sign in any language Now by raising the key the battery is thrown off of the decompossing points and through Thrown through the magnet M which advances the Drum B ahead ready for the next letter.

I do not wish to confine myself to printing on a strip of paper, as the Brush X might be made to travel over a stwide strip of paper side ways & then back and at evey step decompose a letter or 40 more or less brushes migh be used and a commutator made to throw the electrical connection from one brush to another clear across the paper and after a line had been printed the paper could be advanced and the commutator made to throw the current back to the first brush & thence step by step to each brush until another line had been printed I could dispense with the magnet dto draw the paper and substitute any power manipulated with sutible mechanism and controlled by the key or keys. The bars might be dispensed with and wires substituted or any arrangement by which any given key could select the required number of re- cording points to make its letter

I could dispense with the chemicals and record with ink in this way

n is a stop to pevent d too deep an impression X the ink band

A are the rods 25 more or less in number arranged like levers underneath the keys these eLevers have on their ends the in Printing wires are arranged together in a bunch making a salmost solid square each fine wire being connected to a lever and working seperately from all the rest
The End of all the wires attached to the levers would appear this way:

The word ship being printed thus, \textbf{SHIP}

But somewhat closer and legible, the keys over these levers could have teeth arranged to select the levers or the levers could be provided with teeth which I think the most convenient.

The paper would be fed by a movement derived from the Movement of the key or controlled by such movement. The way I ink the Ends of in this machine I used an Ink band passing beneath between the marking points and the drum or rather paper which passes over the drum. This Ink band is fed along by a movement derived from the key or may be driven by magnetism etc.

This principle of forming letters and printing them on strips of paper or other substances by the depression of keys I believe to be original with myself.

I have shown the principle features here: the small devices are of no consequence being but ordinary movements well understood and easily Combined.

The endOrdinary perforating machine of my invention now in use could be provided with 25 Bars similar to what is called punch bar but much thinner and a cushion in placed of the punches & die used and the ends of these levers being provided with the printing points closely gathered and its put one the Bars so that the depression of the key would carry forward the required number of pins bars to form that letter correspdg to the key.\textsuperscript{1}

\textbf{Witness:} Jos T Murrey\textsuperscript{6} T A Edison Inventor Edison

AXS, NjWOE, Lab., Cat. 1182:13 (TAEM 3:56). \textsuperscript{6}Followed by line indicating a page turn. \textsuperscript{6}Signature.

\textsuperscript{1} Edison subsequently altered his original large perforator design (U.S. Pat. 121,601) to incorporate this arrangement (U.S. Pat. 151,209).
A is the Engine set up on pillars C etc. R is the shaft driven by the Engine. Q is the governor. D is the break wheel arrested in the manner before described by a connecting link F from the escapement lever G. This break wheel is arranged just the same as heretofore described. D is the type wheel N the friction which carries this type wheel around when the Engine shaft R is moving. This type wheel is provided with a long sleeve W which passes on the shaft R down through the Base nearly to where R is pivoted it being prevented from going farther by the pin V or any devices. (The friction might be placed here) now this sleeve has on the release toothed wheel M the vibration of the escapement G releasing the type wheel after the manner of a clock escapement.

This sleeve is provided with an arm K which passes over the path of keys and may be arrested by the depression of any key. Now when a key is depressed the Vibrating lever G is held in such a position that the arrester F is thrown into the path of the pin on the break wheel and arrests it and the machine at the other end is arrested by the stoppage of the break wheel and the consequent stoppage of its vibrating lever and release of type wheel.

The break wheel might be Connected directly on the type wheel in this Case and the lever F dispensed with, this simplifying it, but it would have to have 30 breaks or as many as there are ichats in type W.

An Inventive Flurry
The Escapement might be dispensed with also and a simple magnet with vibrating arm which vibrates in the path of the pin on the break wheel. When the key was depressed on the transmitting instrument it would arrest the break wheel and type wheel on an Open circuit, consequently the vibrating arm at the distant station would be arrested and arrested the break wheel & type wheel of that Machine and when the key was raised the sending machine type w & Bk w would immediately start off and the breaks be sent over the wire & the Magnet & its arrested commence to vibrate. This arrested is not only used to arrest the break wheel but to prevent the recg type wheel from going faster than the sending

Witnessed Jos T Murrey

T A Edison


1. Should be B (above typewheel D).
2. See Doc. 222.
3. See Doc. 208.
4. By "friction" Edison meant a spring around the shaft compressed between typewheel D and breakwheel B. There was another above the breakwheel. This arrangement rotated B and D with the shaft, while allowing the shaft to turn when B and D were halted.
5. In this arrangement, the motor ("engine") of the receiving instrument would drive that instrument's typewheel.

[Newark,] Jany 20 1872

For Printing fractions, the type wheel be made thus

The strip would read

Or the type wheel could be arranged thus

The 8.4.2 being cut in the type wheel where the spaces should be and to print them stop on a closed circuit =

January–June 1872
or it Could be made thus

and the strip read thus


1. The offset numerals 8, 4, and 2 were intended to be denominators of fractions (e.g., %). Edison and Pope had arranged the gold-printer typewheel this way.

2. Edison's stock printer normally printed only when the typewheel circuit was open. See Doc. 207.

3. On this wheel, Q = quarter (¼), H = half (½), and E = eighth (⅛).

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Notebook Entry:

Mechanical Printer

Printing Machine.

[Newark,] Jany 27 1872

An Inventive Flurry
The object of this invention is to print rapidly in roman Letters upon a continuous strip of paper.²

B is the type wheel, P is the shaft running between centers, & Through the bed of the Engine. C is the engine revolving Armature. x y the engine break spring E the battery. This armature C revolves with tremendous rapidity and Carries the shaft P and type wheel B with it by friction, and when the shaft is arrested by the depression of the key A & arm L and the pin K the armature keeps right on revolving and when the key A is raised the shaft is free and the friction of G & C grabs the shaft P & Carries it forward.

A represents the key of which there are 30 more or less. These keys are arranged around in a circle and have a Connection ring of which H. is a part and shows the operation. This ring is connected with one end of the battery to the printing Magnet M & thence to keys So that when any key is depressed the bottom comes in Contact with the ring represented by H and the printing magnet and the Printing is effected. Fowing to the immense rapidity of the revolution of the type wheel it is sure to be arrested before the key closes and the Magnet charges.

I do not wish to confine myself to this particular form as it may be necessary to adapt some devices to ensure the arrest of the type wheel before the printing magnet is closed this may be done by putting on a break wheel on the type wheel shaft and arresting it on a closed circuit, or the Circuit may be closed on the key A at L and the pin K.

What I claim is rotating a type wheel and Shaft by Magnetism, and Catching it by the dKeys and Printing by Magnetism or by any other forces; and allowing the engine to go on after the type wheel has been arrested.

J is a ratchet wheel pawl which works in a ratchet wheel secured to the Shaft. P. The use of which is to prevent a rebound when the pin K is arrested by the key arm L of the
key, the ratchet pawl after the pin strikes L falls in a tooth and holds it there while the letter is being printed.

I do not wish to confine myself to this mode ofree stopping the rebound, as the rebound may be taken up by a roughened wheel in place of the ratchet wheel on shaft P and a pawl with a roughened surface connected to the printing lever which when the lever comes forward to print the pawl would give a forward motion to the type wheel shaft P and bring it to the stop L and take up the rebound thus

[Diagram]

{Witness:] Jos T Murrey   T A Edison

I do not wish to confine myself to magnetism for driving the type wheel shaft as a train of Gearing actuated by a spring Weight or any other force could be made to rotate the shaft, and the printing could be Effected by throwing an arm from the printing lever into the path of pegs on one of the gear wheels or the motion to print could be derived from the downward motion of the key =


1. This entry is continued in Doc. 235.
2. Here Edison has turned his universal private-line printer into a typewriter ("hand printer") by omitting the transmitting mechanism. Edison developed this machine during February and March, and on 18 April he submitted a patent application based on the second "printing machine" in this document (U.S. Pat. 133,019). Cat. 121:42–47, Accts. (TAEM 21:165–67).

[Newark,] Jany 29 1872

I have this Printer arranged in this form now

H the shaft. P & G the device previously described to prevent the rebound. BC a sleeve on which is secured the type
wheel B, star correcting wheel a held up by the collar X. E a detent for correcting position of type wheel. The sleeves & its devices is connected and Carried around by the shaft H by a slot in the sleeve & a pin in the shaft shown at D. this slot is larger than the pin and allows some dead motion so that when the shaft is suddenly arrested by a key and it should rebound so that the pawl G did not happen to fall in the right tooth the type wheel being a little loose the detent E would bring it right when the printing lever came forward.

The speed on this printer might be increased by Cutting a double Alphabet on this wheel without increasing its size and double the speed could be obtained in printing without increasing the speed of the rotation of the shaft H but the letters would have to be a little smaller.

I may find it necessary to attach the interrupting break wheel to the main shaft to interrupt the printing lever current so that it cannot come forward until the type wheel has stopped. I used this on my Printing Machine the patent of which has already be applied for =

T A Edison

AXS, NjWOE, Lab., Cat. 1182:20 (TAEM 3:60).

1. This entry is a continuation of Doc. 234.
2. U.S. Patent 133,841, for which Edison had applied on 13 November 1871.

Notebook Entry:
Chemical Printer and Automatic Telegraphy

[Newark,] January 30, 1872.

I will now describe another printer worked chemically.

An Inventive Flurry 438
A description of this apparatus is not very necessary. There
are 30 keys. Each key is provided with a comb and under
five contact points. Underneath the keys is a long piece of
hard rubber and metal letters of the Alphabet sunk in it flush
with the top. Each there is a recording comb also of five
wires rests on chemically prepared paper rotated by a drum
which is driven forward by the depression of the key. Now
the first wire in every key come are all connected togeth-
er the second wire of every comb is also connected and so
on now the first wires of all the combs being connected to-
gether they are then connected to the first wire of the record-
ing comb the second to the second. Now all the metal letters
are connected together and attached to a battery and the drum
is attached to the other end. So that by depressing a key its
comb passes over the metal letter and makes contact
sending necessary pulsations to the recording comb to pro-
duce that particular letter after the manner of the Bonneli
Type Chemical Telegraph.

While the letter is being made the paper advances by the
action of the key. The letters might be placed on the key and
the combs be made stationary.
The recording pen might be made to travel back and forward over a sheet of Manuscript paper and Make a MSS Copy. Thus

BA is the main roll  B Travelling pen  the rest is easily understood = "The usual devices can be used similar to that used on my Mechanical printing Machine.

This is a new movement on my perforator for throwing the punch bars forward

A goes forward by depressing the key until the round end of the cross bar goes over the top then the punch bar is thrown back by the action of its springs carrying the cross bar with it. Now when the bellows A comes back it throws the cross bar upward by reason of the incline on the elbow & passes under it there being enough dead motion in the brass bar to allow of this.

The Cross bars have heretofore been pivoted or had their fulcrum of a shoulder screw the thirty being secured on one long bar. Now I propose to dispense with drilling & taping 30 holes and using thirty screws by casting slight tuts or
bosses on this bar & milling them up and putting the cross bars on them & preventing them from coming off by fastening a plate over the whole of them thus

A the brass piece  D the boss or tit  C the long bar the tit & it being Cast in one piece  B is the plate which prevents these Cross pieces from slipping off of the bosses

I propose to try the experiment of dispensing with a spring to each key in my perforator of which there are Thirty= by using a friction plate and have small pins on the keys and when the key rises suddenly it comes up sideways against this plate and puts a slight friction on it sufficient to hold it there until again depressed

Now all the keys being held up this way I put a rod extending underneath the whole of these keys and connect a couple of springs to it and when a key is depressed it carries this bar with it and when let rise the spring on the bar throws it up and the key with it.

On paper feed for the perforating Machine I propose to alter it by putting in a Swivel on the paper feed dog. Thus

B the stage  N the swing lever connected to the rock shaft this Lever performs an arc of a circle  n is a swil swivel into which the click [C] is pivoted  X is a guide pin to keep the click straight

Device to get a constant spring motion of the rock shaft of my perforator. Thus
A is the rock shaft  B a spring  C a cam or eccentric shaped wheel  n is a pin to which is secured the cord connected to the spring B.

Now when the shaft is rocked the spring gets eel closer to the fulcrum by reason of the eccentric wheel  I go to bed!

[Witness:] Jos T Murrey

T. A. Edison


1. On the facsimile telegraph system of Gaetano Bonelli, see Doc. 46.

[Newark,] Jany 30 1872

On page 27 I describe a printing machine by which the type wheel returns to zero everytime a letter is printed. I will now describe a several way in which it can be done.
B a magnet a a cord d ungers break When the type wheel has been rotated to proper position the printing lever come up effects the printing closes the circuit in the relay and the Relay lever goes forward tightens up the Cords and pulls the wheel & shaft back to zero Again!

G the printing lever b the type wheel a the shaft with teeth cut in it C an intermittent rack pulled downward by a weight and released by the printing lever moving the pallets D by aid of bar F and link E Thisee pallet release pins on side of C the action of this mechanism is easily seen.

Witnessed Jos T Murrey Thomas A. Edison


1. This description actually appears on page 22 of the notebook. See Doc. 194.

2. Nothing is known of William Unger's breakwheel.
Device or attachment which I use on my universal machine for printing correctly when the type wheel is stopped by a key a Little out of Line.

In my universal printing Machine, when sending the type wheel shaft is arrested by a key on the open circuit and a Little before the escapement lever throws the type wheel to its proper position for printing. I do this to obtain a slight movement of the lever B after a key is raised so as to release the break wheel C by the arm D, but in doing so the type wheel providing no devices for prevention were used would be stopped half way between a letter and when the printing lever came up would print ½ of one letter & ½ of the other. Besides and objection would arise which is that it would be necessary to move the type wheel forward a half a letter before the circuit of the printing lever would be opened. Now this it couldn't do. Consequently the whole machine would stay Locked of course the printing lever might be thrown forward and the momentum print the letter & fly back out of the road,1 or a device could be used so that when the type wheel was arrested the printing circuit would close for an instant print the letter & cut itself out until the next letter.2 I have used it in such an arrangement on a previous model of the Universal but consider them all objection-
This shaped tooth allowing the detent to correct the wheel and then go a little farther to allow the printing lever to print without moving the wheel.

I do not wish to confine myself to any particular devices for correcting the wheel but claim a dead motion of the type wheel upon the shaft so that a forward movement or backward movement can be given that type wheel by the action of the printing lever.

The correcting wheel and detent should be made thus:

[Diagram of a disk and a shaft with a detent and a guide pin]

A is a disk. B the type wheel. C D the shifting pins. When you lock rotate shaft so as to bring the Shift fork under d close printing lever this throws the disk over on printing lever and prevents it from coming up to unlock advance to C & close ptg lever.

[Witness:] Jos T Murrey

January–June 1872
I mention here that on my universal the click on the printing lever which corrects the type wheel should be a little springy at least something should give. I have so fixed it already =


1. See Doc. 193.
2. See U.S. Pat. 123,005.
3. The letter F should be E.
4. This design is for the universal stock printer. The sketch at the right is of disk A, showing the notch through which the protrusion on the printing lever passed when the disk was shifted.

New Device on Universal

I use the correcting device, and closing the Local Ptg circuit both on the vibrating spring and on The arrester. But combine another point of closure for the Printing circuit when Transmitting. Underneath all the keys is a plate. This plate is insulated and so connected to the switch which I use that when Transmitting The Local of the printing circuit cannot be closed until the arrester comes in contact with the pin on the break wheel and a key is depressed & in connection with the Insulated plate before mentioned. Now when the key is raised the circuit of the printing lever is broken before the arrester arm is allowed to release the wheel [-]so the printing lever gets away from the type wheel before it starts which is necessary as the Printing lever pressing against the Type wheel puts a large amount of friction in it which on the shaft and the power of the spring is not sufficient to pull the escapement lever home and rotate the type wheel without it is very strong consequently it sometimes sticks and the break wheel is not released by breaking and closing the Local Printing circuit in two places it allows the pgt lever to fly back before the type wheel starts. Consequently there is no friction on the shaft when this takes place.

There is one disadvantage to this and that is the great number of points of contact.

I have dispensed with this and use it Mechanically thus
G is the shaft which is rotated by the escapement. C is the collar or sleeve on which is the type wheel a & corrector wheel b. Now this sleeves is larger than the shaft and consequently will move sidewise slightly. D is the printing lever. E is a rigid arm having a round forked end around the sleeve and is just long enough to throw the whole sleeve dead motion or shake in the sleeve towards the printing lever.

Now when the printing lever is closed the whole pressure comes on the arm E and not on the shaft G consequently when the escapment acts on the shaft G to rotate it there is no friction or pressure of the from the Pg lever.

[Witness:] Jos T Murrey


Signature.

1. This entry is a continuation of Doc. 238 and is continued in Doc. 243.
2. See Doc. 238.

A is a permanent magnet acts on peice iron of H on armature E. F is Line magnet. K its armature. Lever E pivoted at G plays between two points C.D. B is handle for adjusting permanent magnet closer to its armature.

The object of this invention is to dispense with a spring weight gravity etc and adjust with a peice of magnetic steel. I get around the page patent in this ways not opening the circuit.
When the lever flies back the circuit is only lengthened (ie) its resistance increased

Another way

X is a tube the points being in water when the points are separated the circuit only passes through the water but is not broken =

I claim increasing & decreasing the resistance of a local circuit by the action of the relay of another circuit, or mechanically increasing & decreasing the resistance of any circuit by resistance thrown in & out by a break or contact points to produce effects at a distance on that or other circuits

[Witness:] Jos T Murrey

AX, Niwoe, Lab., Cat. 181:16 (TAEM 3:182). 'Interlined above.

Signature.

1. Telegraphers had to adjust relays often to compensate for changing conditions on telegraph circuits. See Doc. 30, n. 1.

2. In 1868 Charles Page received U.S. Patent 76,654 for an "Improvement in Induction-Coil Apparatus and in Circuit-Breakers." Claim 14 of the patent covered the "employment of one electromagnetic instrument to open and close the circuit of another electromagnetic instrument"—that is, a telegraph relay. Western Union bought a controlling interest in the patent in 1871 and filed infringement suits against other companies for using relays. Post 1976, 171–81.

Edison is here working on the automatic telegraph system for which a noninfringing patent would be important. Apparently he had Henry Thau and David Hermann construct such a relay at their shop in New York in June. Cat. 1873:9, Accts. (TAEM 20:9); Wilson 1872, 539, 1193.

3. Edison devised a similar relay in 1867. PN-69-08-08, Lab. (TAEM 6:771).
Notebook Entry:

Automatic Telegraphy

Hollow Cutting Punch Manner of getting rid of the chips thus

B is the punch\(^b\) X a raw hide platen on which the cutting punch B cuts\(^b\) a is a small hole through which a wire (small) runs\(^b\) sathis wire being stationary. When the punch moves down and cut a peice th from the paper this sticks in the punch which in coming up the wire punches or shoves it out. =

I have another device by which the punch or cutter when it comes on the paper presses hard and turns around\(^b\) thus cutting it out after the manner of a knife =

Mrs Mary Edison My wife Dearly Beloved Cannot invent worth a Damn!!

T A Edison

AXS, NjWOE, Lab., Cat. 1172:31 (Tphem 3:93). *Word preceded by "\(x\)", "\(x\)(x)" interlined above in an unknown hand.

Notebook Entry:

Automatic Telegraphy

Perforating Apparatus

This invention consists of a set of cutting wires or punches which press on the paper and turn around at the same time by the action of the Levers worked by the keys and a steady pressure kept up by a spring on the key bar thus
D the key C the punch lever or key bar A the cutting punch which has a spiral groove cut in it like a twist drill into which groove a tit from the key bar C runs X is a spring. When the key is depressed the key bar C is depressed the spring X hitting the top of the punch A brings A down on the platen of raw hide Q & on the paper and the downward motion of the bar C and the tit rotates the cutting punch A and cuts a round hole in the paper after the manner of a knife or rotary shear.

I have only shown one punch lever and punch I use nine. The spiral groove in the punch A might end near the top and a spring attached to the punch A to pull it down on the paper when the lever C is depressed but the tit on this bar would lift the punch up off of the paper when at its normal position as the spring on the bar C would be much stronger than that on A.
Printing Machine X crown wheel with cam slots depress a key throws type wheel around in right place and lever hits pg lvr prints.

Described to [---] Unger

T A Edison

AXS, NjWOE, Lab., Cat. 1172:32 (TAEM 3:94).

[Newark,] Feby 6th 1872

Notebook Entry:
Printing Telegraphy

-243-

another device

a the corrector b type wheel F carrier. C sleeve D long center screw E on which sleeve & type w turn E pin keep sleeve in centr screw H shaft G escapement In this Case shaft H don't carry around The type wheel is not on the shaft H but on its upper center screw it being carried around by a dog or carrier F secured to the shaft H provided with a slot and into which is a pin from the type wheel sleeve C—having sufficient dead motion to st allow of the type wheel being corrected. the worm or unison may be on the shaft or on the sleeve In Transmitting it is necessary to throw the unison out. This I can do by bringing the printing lever up a little toward the type wheel or by throwing the unison arm out directly— The Engine could be stopped always in a given position by the action of the switch so as to ensure that it will start off when the current is put on which it dont always do now.

T A Edison

January–June 1872
1. This entry is a continuation of Doc. 239 and is continued in Doc. 244.

2. A center screw has a conically concave end into which a point fits—in this case, the end of shaft H. Edison had already used center screws in the universal stock printer and in the instrument for the Financial and Commercial Telegraph Co.

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Notebook Entry: Printing Telegraphy

[Newark,] February 6th 1872.

I will mention here that it may not be necessary to arrest the break wheel at all in this printing telegraph. The circuit might be opened by an action derived from the pin on the type wheel shaft and the keys a circuit opener being on these prongs or otherwise. So that when the keyprong come in contact with a key it would open the main circuit just at that moment and when the key was raised closed it the break wheel going constantly would at all times furnish breaks but even they would be nullified by opening the circuit =

Unison

One revolution of Escapement Shaft or rather of type wheel shaft X bring pin c in tooth of rack n lifts it one tooth next revolution on[e] more tooth & so on until the arm H throws arm K in path of L when shaft is arrested when printing lever comes up the arm G throws Rack & bar n down again & so on

Two type wheels, fraction & letter wheel letter wheel sets so that the letter will be opposite space on fraction wheel so that when it is printing from fraction wheel will not print its space coming over pad by rotating type whls round right
position & closing ptg Iver the T peice shifts the pin in the slot X and cams the fraction wheel ahead & right to print & same time throwing letter wheel behind so its space will come over pad

It Can be done on one wheel letter then a figure letter then figure & so one when 60 characters 30 teeth in escapement each twooth shares two letters So every other one being a letter letters only print now come round to right position & shift and came wheel slightly ahead then fractions & figures will be right to print & letter not\(^3\)

T A Edison Invintor

AXS, NJWOE, Lab., Cat. 1174:44 (TAEM 3:29).
1. This entry is a continuation of Doc. 243.
2. This unison is for the universal stock printer. Cf. U.S. Pat. 138,869.
3. Edison used this idea in two patented modifications of the universal stock printer (U.S. Pats. 131,341 and 138,869).

---245---

Notebook Entry: Printing Telegraphy

In my universal I have placed the Engine directly beneath the Printing Machine and underneath the base thereby Making the Machine Much More compact

The break wheel on my Universal has two closures or metallic teeth and between these teeth is filled with Ivory. It is not necessary to have anything there as a limiting pin Might be used on the arm carrying the Contact rollers. [-]Still I prefer to use Some substance between these contact teeth so that the roller will not knock their edges off and also to prevent noise. Now I have found in Experimenting that glass is the best thing that I can use as the spark does not interfere with it as much as rubber ivory, bone etc and what is still better agate or garnet could substituted

There is considerable oxide formed on this Contact point and I propose to use a brush rubbing Continuously up it to keep it clean also upon the Contact roller

I will mention that the break wheel or pulsator may be made of metal Entirely and no breaks in it and the Vibrating arm may have a Contact spring upon it and this would be held on and taken off as the wheel Vibrates

It is not necessary that the pulsator should be exactly as I now use it is may be made thus

January–June 1872

453
C is the arm arranged to the Escapement lever. N is the wheel carried around by friction. X is a flange on it which has two wavy [-]teeth. B is a lever which closes & opens the main circuit on the point Q. The Vibration being had by the rotation of X and the two wavy teeth.

I have shown in former descriptions the type wheel is arrested by the key ½ way home² consequently there [-]must be some device to throw the type wheel in the right position to print.

I can get rid of this device thus

In this Case the type wheel, Escapement etc is precisely like those in ordinary printers, but an extra shaft on which is a star wheel. This star wheel giving Motion to a Lever which arrests the pulsator. Now this second lever runs under the base and is stopped by the Keys. The type wheel shaft will always be right for printing when sending and receiving, but the extra lever which is carried around by the type wheel shaft will be arrested in a position to throw the arrester arm into the path of the pin on the pulsator.

This arrangement Can be done with one shaft, the extra shaft being replaced by a sleeve.

Thus
F is the Main shaft. D a wheel which gives motion to the arresting lever C. A is a sleeves with theis wheel D on also with the key arms Q and R. B is a slot having a pin in it and a spring fastened to the sleeve to pull it around against the pin. Now when a key is closed the escapement comes Rotates around tuill it stops home but just as it going home the arm on the sleeve comes against a key and the sleeve is arrested and the pulsator is caught but the Escapmt lever pulls the tyspe wheel home the dead motion in the slot allowing this the moment the key rises the spring pulls the sleeve up around instantly against the pin in the slot B before the type wheel shaft starts to move.

An Extra Magnet might be used to rotate the shaft which has arms on and the Escapmt lever have arm which arrests pulsator, and The Type wheel shaft be Entirely independent and be rotated by another Magnet & Escapment lever or a springy Connection might be attached from the Escapmt lever which rotates the type w shaft to the lever which rotates the key shaft and the Extra Magnet dispensed with.

Witnessed T A Edison

AXS, NjWOE, Lab., Cat. 1174:46 (TAEM 3:30). *Interlined above.
1. See Doc. 250, n. 6.
2. See, for example, Doc. 238.

Notebook Entry: Printing Telegraphy

-January–June 1872-

I have tried nearly all kinds of self acting breaks upon the Escapmt lever of the Universal so as to dispense with the Engine but a change of adjustment of that lever increases or de-
creases the speed whereas the Engine does not to any great extent. another defect in a self acting break is that it is a very hard matter to regulate the break

Escapement

X is a dog with a cam end B a face pin wheel. when it goes up it cams ahead by the inner row coming down by the outer row—

Another Escapement

another geneva stop

An Inventive Flurry
Travelling type wheel this wheel is rotated the same way as the ordinary printing Machine by an Escapment etc.

The shaft is provided with a key seat which the sleeve and type wheel travel endwise. B is a ratchet having a pulling by its side and this ratchet is rotated by a pawl from the printing lever. There is a string leading from the type wheel to this pulley which turns the corner on a little pulley wheel the other End of the type wheel is attached a spring.

Now the very time the type wheel is printed from the upward movement of the ptg lever winds the string up the distance of one letter. When the type wheel reaches its full length it throws out the detention click and the spring pulls the type wheel back to its starting point and restores the detention click an attachment may be made with the detention click to feed the paper a line ahead when it is moved.

I am going to get up a machine with 26 trains of differential gearing. Each gear having a letter of the Alphabet and taking a hundred words and turn the gearing in such a manner that a few letters will be the result of these hundred words and these letters Can be transmitted over Atlantic Cable and then another Machine in London Can be set at these Letters and rotated backwards until the 100 wds are indicated I can either indicate or print the result².

Escapment wedge acting square teeth.

This is an old invention of mine but I record it.
Paper feed for Printing Telegraphs.

When you bow the paper the click prevents it coming back but when the bower attached to the printing lever goes up it lifts the click off and the paper straightens out by its own action thus throwing itself right for the next letter. Tried in 1869.

T A Edison

AXS, NjWOE, Lab., Cat. 1174:50 (TAE M 3:32).

1. A Geneva stop (also called a Maltese cross stop) was a clockwork device to prevent overwinding. The wheel with concavities on its perimeter (B in the accompanying diagram) was properly called a Geneva wheel (Maurice and Mayr 1980, 313). The diagram is from Brown 1896, 54.

2. Edison made no other reference to this idea.

Notebook Entry:
Printing Telegraphy

Type wheel with the letters placed as shown so as to get as small a diameter as possible. A twist drill might be used and the letters cut along the twist and be rotated so that for every movement of the ratchet a new letter would come into position a pin following in the groove would give the endwise motion and the ratchet would give the rotary motion after the drill or shaft having types would reach its limit it would be thrown back instantly by lifting out the pin in the groove & using a spring.

An Inventive Flurry 458
Device for a two wire instrument. Close current on one wire one magnet draws escapmt armature one way close on other wire other magnet draws the other way close both mag circuits and both magnets close bringing down printing lever.

Polarized relay bad iron or residual magnetism used only no steel.

Device for using two type wheels having 15 character on one and 15 on the other and 315 teeth in the escapmt and a shifter on the shaft so that in rotating it will shift on one & then the other.
I claim slowing a printing lever by a piston attached to the printing lever run in a tube of mercury^2

T A Edison

AXS, NjWOE, Lab., Cat. 1174:54 (TAEM 3:34).


Drawing from Edison's patent for an air-cushion printing lever.

2. In U.S. Patent 128,604 Edison used a cylinder filled with air to accomplish the same purpose (see drawing above).

[Newark,] Feb 14 1872

any of the arrangements described in my description of an apparatus invented for Andrews described in another book^1 can be applied to the printing lever

60 characters on the wheel 60 teeth in the escapment figure between each letter stop on open circuit to print letters and on closed circuit to print fractions and figures My Wife Popsy Wopsy^2 Can't Invent^2

An Inventive Flurry 460
Polarized Relay tongue being polarized by a Local battery. Model constructed in 1869—In Genl Lefferts possession

Escapement

x x' Little wheels

Escapement

Escapement motor Pin wheel.
Although the book referred to has not been found, it is clear that Edison had been working on machines for Elisha Andrews’s English stock telegraph venture since its inception the previous spring. See the accompanying sketch and, for example, Cat. 1212:96, 238, Accts. (TAEM 20:746, 809).

An Inventive Flurry 462
2. Robert Conot claims that the name "Popsy Wopsy" was from a contemporary music hall song. Conot 1979, 47.
3. Nothing is known of this model.
4. During February 1872 Edison filled a separate notebook with over one hundred escapement designs. EP&RI.

"BABY" PRINTING TELEGRAPH  Doc. 249

In February 1872 Edison executed a patent for his "Baby" telegraph, a compact printer with a single typewheel. It is not clear whether Edison intended it for private lines, stock reporting, or some other purpose. The design incorporated a polarized relay and used only one circuit wire. A single armature and magnet combination actuated both the typewheel and the printing mechanism.

The only evidence that this printer was ever used is an illustration of a printing telegraph found in a popular mechanical dictionary published in 1876–77. There are no notebook entries relating to its development, and only one possible manufacturing record remains.

1. U.S. Pat. 126,530. See the patent drawing reproduced here.
2. The typewheel on the patent model (Doc. 249) has thirty blank spaces, the same number of characters as on either the letter or number typewheel of the universal stock printer.
4. Edison paid Thau and Hermann on 8 June 1872 for two "very small printers." Cat. 1213:9, Accts. (TAEM 20:9).
Patent Model: Printing Telegraphy

M (8 cm × 10 cm × 12 cm), MiDbEl(H), Acc. 29.1980.1308.
1. See headnote above.

2. Edison executed the covering patent on this date. Pat. App. 126,530.

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[Newark,] Feby 16 1872.

Notebook Entry:

*Printing Telegraphy*

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M is the printing Magnet X is an extra magnet in same circuit. they both respond together but when the printing lever just touches the type W[heel] the relay points close and cut it out and it flies back.

I use this device for slowly up mechanism and performing this operation.

Thus
X is the main line relay front point\(^3\) vibrating works type wheel around now when Type wheel in right position open main line relay lever \(X\) flies back closes Relay \(Y\) which closes printing circuit in which is cut off relay \(Z\) and printing Magnet—\(M\)—both close and the moment letter is printed Relay \(Z\) cuts current out of printing magnet and lever flies back.

On the break wheel is a plate which has two teeth bevelled\(^5\) \(X\) is an arm having 2 prongs one each of which is two little friction rollers and every revolution of the Break wheel and the rollers engaging with the bevelled pins an intermittent motion is given arm \(X\) which acting on the escape-ment wheel Rotates for every revolution of the break wheel the ratchet is advanced two teeth there being 2 breaks on break wheel and 2 bevelled pins. one prong is only necessary by using an spring in place of the other.

by depressing a key the ratchet wheel shaft is arrested this stops the arm \(X\) which arrests break wheel.

one of these prongs is insulated and connected to the printing wire and when the break wheel is suddenly arrested the roller comes in contact with the bit bevelled tooth and closes the printing circuit. I have a machine already made.

T. A. Edison

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An Inventive Flurry 466
Arrangement of the Break in the universal

AXS, NjWOE, Lab., Cat. 1174:60 (*TAEM* 3:37).

1. The armature of X.

2. This was done in an attempt to ensure that the printing lever touched the typewheel as briefly as possible. Proper operation would depend on the adjustment of the springs against which M and X pulled. The retracting spring for the printing lever is not shown.

3. The front point was the relay contact on the same side of the armature as the magnet—that is, the point touched by the armature when the magnet was charged.

4. Z corresponds to X in the first sketch in this document.

5. In this sketch Edison was again attempting to devise a mechanism to stop the breakwheel of the universal private-line printer (cf. Docs. 193, 222, and 225; and see n. 6 below). As labeled in the diagram at right the motor was at the lower end of shaft M; breakwheel B rotated with M by dint of a friction spring, but could be stopped without stopping M; arm X would pivot somewhere near its middle; and the keys were represented by K. The labels in Edison’s sketch are (clockwise from left) “Printing circuit”, “type wheel ckt”, and “Battery”. Because Edison did not refer to a typewheel either verbally or visually, it is not clear whether this mechanism was intended to function as a receiving instrument.
6. This drawing is a clearer illustration of the idea sketched above. Note that the motor magnets are horizontal, an arrangement Edison used on his universal transmitter (U.S. Pat. 131,343). See Docs. 211 and 245.

[Newark,] Feb 26th [1872]

Universal break wheel working shaft that has stops on for arresting by keys with gear wheels. I have previously shown & described it working with a ratchet wheel for the ratchet or intermittent & substitute gears a geneva stops wheel might be used in place of the gears having 30 Stops on the shaft wheel & one on the break or more

This gear was previously suggested to Dean\(^3\) Feby .1. and thought before while writing description on page 29\(^4\)

AX, NjWOE, Lab., Cat. 1147:64 (TAEM 3:39).

1. This entry is continued in Doc. 253.
2. See Doc. 246, n. 1.
3. Charles Dean (n.d.), a mechanic at Edison's Newark shops, was later important in the organization and management of the machine works Edison established in New York City for the manufacture of his electric lighting system. Jehl 1937-41, 676-77.
4. See Doc. 223; cf. Doc. 211.
Murry & Co. Thos A Edison. Mfrs Tel Instruments
111 NJ RR Ave.

Newark, Mch 6/72

#3700² Are just putting in their machinery, and will soon commence work. "E" is of the firm of E & Unger "M" has no means of his own. "E" is said to have some little means in R[real]. E[state].³ & to own ½ interest in firm of "E & U" Are v[ery] little Kn[own] here, & we cannot get information wh[ich] seems to warrant any extended Cr[edit]. 2092

D (abstract), MH-BA, RGD, N.J. 21:125. "Thos Edison," interlined above; "A" interlined above that. Followed by "(Other reps 'E' see 'E & Unger' 3/238)"; the numbers "3/238" are the volume and page numbers for related credit reports.

1. R. G. Dun & Co., established in 1841 as the Mercantile Agency, was by 1871 one of two major credit-reporting firms in the United States. In the early years selected local correspondents, such as attorneys, bank cashiers, or established merchants, reported the standings of local businesses to the central office in New York. Clerks there transcribed the narrative reports into large ledgers organized by state and county, and from these ledgers they derived requested information for subscribers. Later, the agency opened local reporting offices with full-time agents. A Newark office opened in 1871. In 1933 R. G. Dun & Co. acquired its largest competitor, the Bradstreet Co., thereby becoming Dun & Bradstreet, Inc. In the early 1960s the company deposited over two thousand ledgers, covering a period from the 1840s to the 1880s, in the Baker Library of the Graduate School of Business Administration, Harvard University. Dun & Bradstreet 1974.

2. This number refers to the agent making the report. The book containing the matched codes and names has been lost. The number at the end of this document is repeated in the left margin; its meaning is not known.

3. See Doc. 206.

Notebook Entry:
Printing Telegraphy

[Nearwark,] March 6th 1872

Carrier for break on the universal printer

January–June 1872
I claim Turning a type wheel by an engine (electric) and releasing it step by step by an Escapement and Magnet the pulsations being derived from Sama a break on the shaft of the Engine which rotates the type wheel =

Unison for Callahans 3 wire Machine

Attachment to Universal Stock Printers, to prevent back lassh in Escapement wheel when they are run at High Speeds.
Printing Telegraph Machine\(^5\) The Engine eshaft carry-
ing the Type wheel and released by the escapmnt lever &
Magnet X

\[\text{T A Edison Inventor}\]

Positive Paper Feed for Printing Telegraphs\(^6\)

AXS, NjWOE, Lab., Cat. 1174:65 \((TAEM\ 3:39)\). 'Written in right mar-

1. This entry is a continuation of Doc. 251. It is the last entry from
1872 in this notebook and is followed by four blank pages.

2. See n. 4.

3. Lefferts had requested such a unison two months earlier. See Doc.
220; see also Edison and Unger accounts for 10, 20, and 25 April 1872
(Cat. 1183:99, 101, 104, Accts. \([TAEM\ 20:909-10, 912]\)).

4. The five sketches on p. 471 show pawls designed to hold the es-
capement wheel. No surviving machines exhibit such a modification.

5. In this design the motor provides the motive power for the type-
wheel, and the escapement acts as a true escapement, releasing the type-
wheel rather than driving it. The motor armature is of the form used in
the universal transmitter; that is, it is three-lobed. See Doc. 211.

6. In the sketch preceding this heading, the horizontal bar is the
printing lever viewed from the side and fixed to a shaft at its right end
(not shown). The small circle within the large circle is a fixed shaft on
which the lever for the paper feed pivots.

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Edison and Unger.\(^4\) Telegraph Fixtures. 4 Ward St.\(^1\)
3700\(^2\) Have been in bus some 12 Months or more. Man-
ufacture the Gold & stock Brand Tel Instruments\(^3\) & claim to
have a monopoly. "Unger" states that they have abt 22m$\(^4\) in-
vested in Machinery & Stock,\(^5\) & that none of this is bor-
rowed, & that "E" owns some little R[cal].E[state].\(^6\) "Edison"
was formerly connected with the Am Tel Wks, Is an ingenious
Mechanic & inventor. Formerly came from Ohio. It is inti-
mated that Mr Harrington Pres of the Automatic Tel Co. 80
B'way N.Y. has claimed that "E" started his bus here in Ward

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\(^{\text{An Inventive Flurry}}\)
Workmen and instruments in back of Edison and Unger's Ward St. shop.

St & got his Machinery with his (H's) money. We can learn very little of this firm, beyond their own statement, and without further knowledge of them cannot advise extended Credit. "Edison" is also of "Murry & Co" a new firm just starting. The Bank a/c is in the name of "Wm Unger," and checks payable to the firm are first endorsed by the firm & then by "Wm Unger." Their transactions indicate a large business.

D (abstract), MH-BA, RGD, N.J. 22:238. Followed by "(Other reps 'Edison' see 'Murry & Co' 2/125)"; the numbers "2/125" are the volume and page numbers for related credit reports.

1. See Doc. 157, n. 2.
2. See Doc. 252, n. 2.
3. Universal stock printers.
4. "m" means thousand.
7. Edison had begun to transfer machinery to Edison and Unger from the American Telegraph Works in the fall of 1871. Quad. 70.7, p. 705 (TAEM 9:722); 73-003, DP (TAEM 12:1001-34 passim).
8. See Doc. 252.
9. "a/c" means account.

SIX-KEY PERFORATOR  Doc. 255

Edison began working on perforators for automatic telegraphy to fulfill his 1870 agreement with Daniel Craig. He designed the following perforator as an inexpensive alternative to the
large machines used in main offices, intending it for local offices or customers wishing to prepare their own messages.²

Edison's first perforators had been large, rapid instruments with a separate key for each character. By February 1871 he was designing smaller perforators.³ Edison apparently completed a six-key perforator about 17 May 1871.⁴ However, he did not execute a patent application for this perforator until 15 March 1872, which suggests that he reworked the apparatus in the interim. The patented machine contained one key for dots and a second key for dashes. The other keys were used to space the perforations and to operate the paper feed.

As in his earlier, large perforator, a single hole in the tape transmitted a dot. There was, however, an important change in the form of the holes that produced dashes. The large perforator punched out a dash using three holes of equal size, one above and between the other two. In his six-key perforator, Edison altered this design so that the single dot was larger and overlapped the two smaller holes. In this way, he sought to "insure a metallic contact of the brush or transmitting stylus between one of the smaller perforations and the other, thereby producing a dash-mark."⁵

1. Doc. 103.
4. See Doc. 166, n. 3.
Patent Model:
Automatic Telegraphy

M (16 cm dia. × 14 cm), MiDbEl(H), Acc. 29,1980.1606.
1. Edison executed the covering patent application on this date. Pat. App. 132,456.

January–June 1872

475
New Idea for Printing Telegraph machine

A are 7 bars are moving 7 levers c up and down off of the recording Drum

These seven levers are thrown down upon the drum by the forward movement of the bars A. This drum carries the paper between the paper and the c bars are is an ink band. The A Bars are provided with 30 rows of tits down the side of which pass the side of 30 key. Now on the side of these tits are the letters of the Alphabet in relief. The key in passing down throws forward these bars according to these relief parts of the letters on the tits. At the same time the paper drum is being fed forward by the downward motion of the key.

It will be seen that this is but a mechanical way of producing the result chemically as shown on page 22 & 23 this book communication being had with the recording pens mechanically instead of electrically.

Further description unnecessary

Driving paper for a perforator

A b c some of the 9 punch levers used in the perforator. X is a lever which has a rack click on the end. Loose going up down rigid going up in a rack connected to a release Escapement lever which releases the paper drum driven by weight, step by step. The last keylever in the punch leves being nearer the fulcrum of X than the first will shove X further now X is going down having a loose click does not Vi-
brate rack \(n\) but in going up vibrates it releasing paper drum a notch every vibration. The number of vibrations being governed by the length which \(X\) has gone down which is governed by the punch used which is nearest its fulcrum it may be used thus.

Description unnecessary

The printing device described on page 27. The seven recording levers might be cutting punches and cut the letter out instead of recording them then this prepared strip could be used for transmitting in a machine already described by me in another book where is use this kind of paper.

Positive Paper feed movement for perforator

Different
Printing machine, different shape from that described on page 27.

1. See Doc. 258, n. 1.
2. Typewriter.
3. That is, Doc. 236.
4. That is, the first drawing in this document.
5. Doc. 194.

[Newark, March 1872?]

Notebook Entry: Automatic Telegraphy

paper feed, The punch bars determining The distance
Twisting cutting punch
This Engine is somewhat dissimilar to that of any other heretofore made although resembling greatly in appearance others.

The outside ring is stationary & is provided with armatures, arranged in relation to the Magnets that when all the magnets are charged every magnet will draw itself up to the armature, the drum carrying the Magnets will then revolve the distance between one of the armatures be charged and draw themselves up again.

The break consists of two toothed wheels [-] Insulated from the shaft & each other and upon which are two springs also insulated from each other. These at the end of these springs are four platina points two above & two below so that when [-] the teeth on the wheels raise both levers up they will come in contact with both platina points and these platina points being connected to the magnets, and the two springs being connected to the battery the circuit is thrown through all the magnets Not as it is usually done but [this?] way...
These magnets and herein constitutes my improvement consists of very fine wire Say from No 20 to 36 or even finer When they are of finer wire each magnet is made thus

five or six Sections and each Connection or section So Connected [that?] the current splits and divides passing through by one wire through the several routes provided for it & emerging to one wire again. these magnets made in this manner are connected as shown on the top sketch or may be thus

It is a law of magnetism that the greater number of convolutions of wire around the Core the greater would be the effect, taking care about the resistance.\textsuperscript{1} heretofore parties experimenting with electric engines use very large wire and thus obtain a very low resist\textsuperscript{ance},\textsuperscript{b} but have but few convolutions. I also obtain an extraordinary low resistance by providing a number of routes each having a large No of convolutions and agregately an enormous number, but they are so Connected that owing to\textsuperscript{b} the no of routes, combined the resistance is reduced from say 300 ohms (if the wire is connected as is ordinarily done) down to 2 ohms, for each magnet and by combining the magnets after this plan I reduce the total Resistance of the several magnets to 1 ohm for the whole and at the same time have an enormous number of Convolutions of wire.

I have discovered that if 100 feet of copper wire if 2 spools has\textsuperscript{[e? ---]} 6 [ohms?]\textsuperscript{c} Resistance and the current is passed through it it will lift say 2 lbs. if now we take a magnet with 24 ohms resistance each spool having 12 ohms & connect them thus

\textit{An Inventive Flurry} 480
We reduce the resistance to 6 ohms but obtain twice the force or 4 lbs without any more consumption of material in the battery.

Another theory I take advantage of in the construction of my engine, which is that in all electric engines or in any new in use the current through the magnet must be broken before the magnet approaches the point where the most work is done; for if this was not done the armature passing over would be retarded owing to the sluggishness which the current or magnet discharges. I get around this by preserving keeping my current on until up to the very center (i.e.) the armature is opposite the cores of the magnet then it will be observed by referring to the break with its upper & lower springs that the current is reversed for an instant through these magnets & they instantly discharge this current is not kept in long enough to effect a recharge of the opposite polarity.

Another advantage I claim is having all the magnets pulling at one time and a large momentum or fly wheel to carry it over the spaces between where there is not put pull.

This splitting of the magnets as described can be applied to other purposes.

I propose to apply it to printing telegraphs winding an ordinary Stock Printer 6 ohm 24 wire with No. 30 wire 24 ohm and by connecting as heretofore shown reduce to 6 ohms.

B. Vitrol Battery

I claim a board perforated with holes and sitting on legs an inch or so from bottom underneath which is Copper sheet.

I claim the saw dust on the perforated botard or material of any kind perforated and a funnel for feeding the underneath the perforated disk with Sulphate Copper.

I claim running two type wheels by two electromotors, and keeping them in unison by a governor on Each engine, and printing by a single move.
1. In the original notebook, the last dated entry preceding this one is from 30 January 1871 (Doc. 236), and the sketch at the end of this notation, showing the universal private-line printer with a vertical type-wheel shaft, indicates that this was written before April 1872 (see Doc. 262 headnote).

2. On electric motors, see Doc. 165 headnote, n. 3.

3. That is, the magnetic strength of a current-carrying wire coil is directly proportional to the strength of the electric current and the number of turns of wire in the coil.

4. If the spools in both the 6-ohm and 24-ohm magnets are made with the same wire, those in the 24-ohm magnet will each have four times as many turns of wire and carry half as much current (when connected in parallel) as those in the 6-ohm magnet (connected in series). Because an electromagnet's strength is directly proportional to the product of the current and the number of turns of wire, this arrangement would result in twice as strong a magnetic field from an identical battery output (the resistance of the two circuits being equal, the battery output would be also). The limit to such an increase is the point at which the electromagnet cores are magnetically saturated, a concept Edison understood (see Doc. 40).

5. Cf. Edison's U.S. Pat. 142,999.

Drawing from Edison's battery patent (U.S. Pat. 142,999).
Articles of Agreement made and entered into this Twenty-ninth day of April A.D. 1872 by and between Thomas Alva Edison of the City of Newark, State of New Jersey; and Marshall Lefferts of the City and State of New York, Witnesseth,

Whereas the said Edison has invented certain Improvements in Printing Telegraphs and the said Lefferts has agreed to act in connection with the inventions and patents on the same in Europe.

Therefore in consideration of the premises and of one dollar in hand paid each to the other the receipt whereof is hereby acknowledged the following agreement is made and entered into between the said Edison and Lefferts for themselves and their legal representatives.

First. The said Edison hereby assigns, sells, transfers and asets over or agrees so to do, unto the said Marshall Lefferts one undivided half part of the right, title and interest of every character in and to any and all Letters Patent in Great Britain that he may hereafter obtain for improvements in printing telegraphs, together with the same right in any invention of or improvement upon printing telegraphs that he has heretofore made or may hereafter make for ten years and to this end agrees to make and execute, at the expense of the said Lefferts, any and all specifications that may from time to time be required for procuring or completing Letters Patent for such inventions and for assigning or more fully conveying the rights hereby assigned or intended so to be unto the said Lefferts.

Second. The said Lefferts hereby agrees to bear the expenses of patenting such inventions in Great Britain, and also in France, Belgium and such other countries as may be mutually agreed upon, but if said Lefferts unreasonably neglects or refuses to bear the expense of patenting any improvement in printing telegraphs invented by said Edison then this agreement shall not apply to the rights in that particular country or to that particular invention in that Country and the said Edison shall be relieved from this agreement to that extent only.

Third. The said Edison hereby appoints the said Lefferts his true and lawful attorney to attend to any and all business in connection with the patenting, introducing, selling, transferring, or negotiating the rights in connection with such printing telegraph inventions in any and all countries of Europe where the said Lefferts may pay the expense of patenting, and agrees to execute any further or more formal power of attorney for such purposes.

Fourth. The said Lefferts hereby agrees to exercise reson-
able diligence in connection with the business hereby contemplated and to well and truly account to the said Edison and pay over to him one half part of the profits that may result in Great Britain in connection with said inventions and Letters Patent, first however retaining his actual cash advances in connection with the same.

Fifth, The said Edison hereby transfers sells and sets over or agrees to assign and set over to the said Lefferts the entire right title and interest of every character in and to the said inventions and letters patent on Printing Telegraphs in France, Belgium and each and every other country on the Continent of Europe where the said Lefferts pays or causes to be paid the expenses of patenting, and agrees to execute any specifications, assignments, transfers, or other documents that may from time to time be required for carrying out the full intent and meaning hereof, or in accordance with the laws of the respective countries.

Sixth. The said Lefferts hereby agrees to exercise reasonable diligence in endeavoring to introduce and make profit by the said inventions in the continent of Europe and to account to and pay over to the said Edison all the profits that may from time to time be realized from the rights on the continent of Europe, (first deducting his actual cash outlay) until he the said Edison shall have realized the total sum of ten thousand dollars, after which said Edison shall have no further claim in that particular.

In Witness whereof the parties to these presents have hereunto set their signatures and seals.

T A. Edison Marshall Lefferts
Witnesses M. C. Lefferts

DS, NJWOE, LS (TAEM 28:949). In unknown hand. *Date taken from text, form altered. **and also in" interlined above in Edison's hand. "in that Country" interlined above in Edison's hand. 5¢ Internal Revenue stamp in left margin. *Followed by a seal.

1. No evidence has been found to show the ways and extent to which this agreement was carried out.

2. There was only one witness, Marshall Clifford Lefferts.

Newark, May 21/72
Murry & Co. Thos A Edison Mfrs Tel Instruments
111 NJ RR Ave.

#37001 "M" states "that they are equal partners "E" furnishing the cash capital 14m$ & he "M" off setting this by
his time and mechanical skill "E" is said to own a house &
lot valued @ 5m$ mtgd for 15c$.  Is also of the firm of E
and Unger. We have no means of confirming particularly
above statement but judging from their machinery & stock
think it must be in the main correct "M" also states that they
are now about 2m$ in debt have little or no competition &
ought to do a good & paying bus 2092a


Written in right margin.
1. See Doc. 252, n. 2.
2. "m" means thousand.

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Daniel Craig to
Marshall Lefferts

New York, JunMay 24/72

Dr General

I am quite sure I can get a substantial pledge from the
Southern Co. of the $25,000 in cash and $100,000 of their
stock or some other of greater value, with the single proviso
that the Fast System proves to be all right between Charleston
and Washington, or New York.3 (They now write Morse, di-
rect & without Repeaters, in bad weather between W. & C. &
in good weather between N.Y. & C.—so we shall have good
wires for the test.)

I wish you could get Edison’s own interests confided to me,
in such a way, first, that his interests and his efforts in every-
thing pertaining to Automatic Telegraphy, will go with your
interests, or not against ours, provided only that he shall be
paid out of the first proceeds of anything from any telegraph
Co. using any system of Automatic or Fast Telegraphy, whatever sum you or you and Pope2 may agree to be fair to him, in
view of what he may have produced of advantage to the fast
system—and his inventions or devices being compared and
estimated by similar (if any) inventions by other parties.

I also want you to give me full-control, to manage according
to my best judgment, all your Automatic interests, inventions,
patents and thoughts (so far as I can draw them out of you)
upon the new system.

Pledging to you as I will and do, my best efforts to make the
interests confided to me so valuable that I can pay you for the
same at least $100,000 of the Stock of some respectable Tel-
egraph Co. within the present year and at the earliest possible
moment.

It is important for me & also for you to get Edison into such
a position that he will work to promote our interests rather than the interests of our opponents, actual or possible, and I should esteem the situation very much safer if you could so manage him as to get his interests where you could fix theirs and keep him faithful to our side in any & every contingency.

I wish you could feel justified in accepting the whole Telegraph interest as collateral security against the claims of that vile dog Vail, as and as I know they are all moonshine, you will not be hurt in the least.

You may easily imagine that Mrs. Craig feels as though if she surrendered her splendid property at Peekskill for less than half its real value, she ought to have something sure & not hypothecated to afford her some support.

Do, pray, try to have this trifling point (trifling to you, but seemingly big to Mrs. C.) conceded, and then I shall hope to make her and Jim reasonably well satisfied with the swap.

Harrington & Little, for some reason unknown to me, are decidedly snubbing Morris & the Southern Co., which is very good for us, and now is the time for me to make a trade with them. What might be the effect of Harrington's getting down from his stilts and evincing a disposition to co-operate with the Southern Co., I do not know.

The sooner you can tell me the result of your expectations in regard to your interests in the Telegraph matter and the Mt Florence property the better I shall like it.

I thought you might like to see a statement of the Mt. Florence Property as embraced in John's scheme. I suppose your suggestion today applied to the Real Estate and Improvements, only, but, of course John must deliver according to the Bond—but you and I can arrange this, by letting John pay Mrs. Craig the actual (selling) value of the Personal property which inventories some twelve or fifteen thousand dollars, but, of course would not sell for that at a peremptory sale.

Of course Mrs. Craig will at my request, give to Smith or whoever may be entitled to receive the conveyance, a perfect title to the property for whatever sum the Scheme can afford to pay for it. The real expectation of Finch was to pay Mrs. Craig $150,000, & share with me ½ of all his profits, but I had no written agreements with Finch or other parties, and have none now with John, but expect him to do whatever may be fair, but no more.

I feel sure he can carry the scheme through & pay $150,000 for the property & all expenses, & make $10,000 to $20,000
for himself, if he can have a credit at the right time—say 1st June—for $10,000 to see the advertising people, & I will give him this credit as soon as I get able, if ever. Truly &c

D H Craig

ALS, NNHi, Lefferts.

1. The Southern and Atlantic Telegraph Co. was negotiating with the Automatic Telegraph Co. for use of the automatic telegraph system on its lines, which extended from New York through Philadelphia, Baltimore, Washington, and Charleston to Savannah (reaching New Orleans in 1873). This was part of a complex series of negotiations between several telegraph companies, including the Atlantic and Pacific, Franklin, and Pacific and Atlantic. These negotiations were intended to produce an alliance in opposition to Western Union. Although various agreements were negotiated, the alliance was never consummated. Josiah Reiff’s testimony, 1:76–113, Box 17A, Harrington v. A&P; Southern and Atlantic Executive Committee Minutes 1870–76, 25, 40, 42, WU; Southern and Atlantic Directors and Stockholders Minutes 1869–73, 85–86, WU; agreements between Automatic Telegraph and Southern and Atlantic, 11 Oct. 1872 and 17 Oct. 1873, WU; agreement between Automatic Telegraph and Pacific and Atlantic, 1 Mar. 1873, WU.

2. Franklin Pope.

3. Unidentified.


5. James Brown was to be Mrs. Craig's agent in the transaction.

6. Francis Morris was active in many telegraph ventures. At this time he and George Harrington were members of the executive committee of Southern and Atlantic. Reid 1879, 452; see also ibid., 281, 310, 370, 417–18, 426, 432, 460–61, 466, 526, 533.


8. Unidentified.

9. Unidentified.

UNIVERSAL PRIVATE LINE PRINTER, 1872

Doc. 262

Sometime in mid-March 1872 Edison abandoned his attempts to make the original universal private-line printer workable, and by early April he had arrived at a new design.¹ He quickly produced several models of this design for Gold and Stock, delivering thirty-three instruments during May and June,² but eight of those were defective. Shipments were curtailed in late June and did not resume until August. By the end of September, Gold and Stock had received nearly three
Because one of the two contact points in the universal private-line printer transmitter was slightly in advance of the other, the second point stayed clean and transmitted a clear signal.

Like the first universal private-line printer, the new machine combined a printer and a transmitter. Unable to perfect the printing mechanism on the original design, Edison used the universal stock printer as the printing portion of his new instrument. The stock-printer design remained basically unchanged, except that the new universal private-line printer used only one transmission wire and one typewheel. Only the typewheel magnet was on the main circuit. The transmitter, on the other hand, retained only the motor and governor of the earlier private-line printer. By having the motor work a set of electrical contact points through a series of ratchets and gearwheels, Edison solved the problems of precision and accuracy that had plagued the first machine's pulsator (break-wheel).

Edison used his screw-thread unison on the universal private-line printer. He recommended that the machines' typewheels be “allowed to run to unison before each communication so as to ensure their correct position.” Edison solved the problem of printing-lever rebound—that is, getting the printing lever to bounce fast enough to avoid holding back the typewheel—by mounting the fulcrum loosely, relying on the lever's upward momentum to make the impression and on gravity to pull it back out of the way of the typewheel's rotation.

1. See Docs. 164 and 165. The last dated notebook entry showing the vertical typewheel shaft of the original design was made on 6 March (Doc. 253). That month, Gold and Stock expenditures on the universal private-line printer rose from February's $179 ($155 labor, $24 stock) to $1,052 ($333 labor, $280 tools, $14 patterns, $425 stock). Outlays for April totaled $2,063. Cat. 1211:42-50, Accts. (TAEM 21:165-69).


3. Production figures exist only for 1872. The total number of universal private-line printers manufactured is not known. PN-72-07-12, Accts. (TAEM 20:986-87).

5. The printing magnet was on a local circuit that was routed through the typewheel escapement lever. Whenever the main circuit was open (between impulses) and the escapement lever was pulled down by its spring, the printing circuit would close. As in several of his earlier printers, Edison made the printing magnet relatively sluggish so it would not respond to the rapid impulses used to work the escapement and turn the typewheel. However, when the main circuit was opened to halt the typewheel, the printing magnet charged fully and raised the printing lever.

6. The motor drove the first gearwheel, which in turn drove the second by a ratchet and pawl. The second gearwheel drove another ratchet, which opened and closed the contact points. Depressing a key stopped the second wheel, and the contact points accordingly stopped vibrating while the motor and first gearwheel continued to spin.

7. NS-Undated-005, Lab. (TAEM 8:259).


Patent Model: Printing Telegraphy

M (28 cm dia. × 15 cm), DSI-NMAH(E), Cat. 252,616. The long arm angled to the lower left would in operation have been one of two arms standing up with a roll of paper tape between them.

1. See headnote above. Edison and Unger sent this machine (serial no. 215) to the Gold and Stock Co. on 11 September 1872. However, the Smithsonian Institution received it from the U.S. Patent Office as the patent model submitted 16 May 1873. PN-72-07-12, Accts. (TAEM 20:987); Pat. App. 140,488.
until they have reached the sum of £ 11 = So you see, with no freight nor packing they beat you in price. Of course they promise better workmanship—and one of them did not hesitate to pronounce ours, as d——d bad—and I immediately turned my back on him= he feels that he offended me, and writes me every few days but I take no notice of him = I have told no one about his low offer, and so long as you can fill orders promptly, and they don't get at the Officers of the Company—all will go bravely on—Don't fail to send duplicate parts, especially springs —& that brass guard over the paper—Small Screws &c any scraps of parts around the shop—throw in the box—as they will come handyb Andrews¹ must have told you that the 12 Insts⁵ were in a very rusty condition and the straw with which they were packed was alive with New-Jersey Bed bugs—and if it was known that I had imported American Bed Bugs into Great Britain, I would be put in Newgate = ⁶ So look out how you compromise me—

By the way = Don't deposit that $360 with Clews,⁷ Go to Duncan Sherman & Co⁸ & buy me a draft on Bk of England, and send it to me by mail = that is the best way to do it = I hope before this letter reaches you, I will order another lot, say 50—⁹ Andrews telegraphed me a few days since, that “50 Insts would go Wednesday”¹⁰ I wonder if that was intended as a reply to my Message in which I asked him to “secure sixty Instruments” it came next Morning early—the letter was then on the way, with the order for sixty— Be sure and not forget the promise of “confidence” write me soon as you possibly can—Yours

E. A. Calahan

Direct letters &c. thus ¹⁵ 18 Cornhill—London, E.C.

ALS (fragment), NjWOE, DF (TAEM 12:893). Only the last two pages of this letter have been found. ¹Place taken from text. ⁵“Small screws . . . handy” written in right margin and set off with line. ⁶Followed by brace containing signature and address.

1. Although both Edison and Calahan invented for Gold and Stock and the American District Telegraph Co., there is no evidence that a close personal relationship developed. No correspondence between the two men has been located. Considering the friendly tone of this letter and the directions in the second paragraph to send money from a Wall Street bank to England, it is unlikely that Edison was the recipient. The letter was probably written to Marshall Lefferts or one of the other major stockholders in the Exchange Telegraph Co. (see n. 3), who then brought this part of the letter to show Edison in Newark, where he was manufacturing universal stock printers for the company. Edison supplied
his tickers to the company for a year or so, when manufacture began in England. The English instruments had the basic design of the universal stock printer with several details altered to increase transmission speed. Scott 1972, 16; Higgins 1877, 122-43.

2. Calahan resigned his position as superintendent of Gold and Stock at the end of March 1872 and sailed for England a month later to become the electrician for the Exchange Telegraph Co. He remained with the company for only one year. (J. Teleg. 5 [1871-72]: 101; “The Gold and Stock Telegraph in England,” Telegr. 8 [1871-72]: 292; Scott 1972, 16). The second shipment of printers left Edison’s shop for England on 13 June (see n. 9). These two circumstances suggest that this letter was written between mid-May and mid-June 1872.


6. Newgate was the prison for London and the adjacent County of Middlesex.

