History of Telegraphy from the Teletype Museum

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(Document Notes)

The Teletype Museum display was set up several years ago by Charley Hill and Ken Lovitt, and served for some time as a magnet attraction for visitors to the Teletype plant. Later, due to the compelling demand for more office space as the company expanded, the Museum was dismantled and the equipment on display sent to storage. A record set of slide pictures was made just before this occurred, and this program is a "walk through" of the Museum as it appeared in its better days. join us for a trip back into the History of the Telegraph Art as illustrated by the machines developed by the in- ventors who contributed so much to communications progress in the old days.

1. Our greeting is an appropriate "START HERE" with the beginning of a series of numbered captions covering various steps in THE HISTORY OF TELE- GRAPHY. Early forms, before 1820 include semaphores and electro-chemical signaling methods, but historical records tell of signal fires, smoke sig- nals, and even an "encoded torch" system in which the lighted torches were placed in numbered notches on top of high walls, the combinations of tor- ches thus indicating the letters, numbers or pre-selected words being transmitted. It was great for both day and night, but look out for rain or fog!!

2. Most people think of telegraphy in terms of the old Morse code Key and Sounder, so this was the first display. The Sounder had a reflector box behind it, amplifying the clicks of the "Dots and Dashes" to the operator's ears. Behind the Key was a power supply that permitted the Station Set to be demonstrated.

3. Here the operator was "working the key", actually sending a message as the picture was being taken. Morse's first telegraph system was not manual like this! Instead, it was automatic, with sending from a set of notched blocks that cooperated with a sending contact. The blocks were placed on the perimeter of a large wheel that was turned by a clockwork system, with the operator picking the blocks out of a com- partmented box, much as an early printer would "set type", then put- ting them back after transmission. Morse actually consulted a printer in selecting the codes for the various characters, making the most fre- quently used ones shorter so as to get the best transmission efficiency.

4. The Sounder was not usually placed in the telegraph line circuit, since its impedance was too high. Instead, a Line Relay like this would be inserted in the line. Again, Morse's original system did not use the Sounder, but had a pen attached to a receiving magnet that would move the pen down to mark a moving paper strip when current was received over the line (MARK signal), and

allowing the pen to be lifted up when no current was present (SPACE). The strip was pulled through the recorder by another clockwork set. The receiving oper- ator was then supposed to decipher the recorded message and write it down on a telegram form. When it was found easier (and it took less equipment) to decode directly from the sound of the recorder, the Sounder was developed. Also, it was much less work to operate a send- ing Key than to handle the clumsy set of notched transmitting blocks. This change set back automatic telegraphy by some 65 years!!

5. Several Early Electric Telegraph developers were at work in the early 1800's, with Morse's "Writing Instrument" coming along in 1835, while his demonstration to Congress between Washington and Baltimore with the famous message, "What Hath God Wrought", was not accomplished until 1844.

6. In 1836, much activity occurred, with Gauss & Weber, Steinheil, Cooke and Wheatstone all making contributions. "Needle" telegraphs, and the related "Dial" system, all using sensitive galvanometers as indicators, were actually put into commercial use in England and on the Continent for many years.

7. Wheatstone's contributions were many, including this type of sensi- tive relay named after him. A polar type, it turned out to be very useful when automatic telegraphy came along.

8. Another of Wheatstone's inventions was the automatic recorder for signals which drew dots and dashes on linearly moving tape, much as Morse's first recorder had done.

9. And the Wheatstone Transmitter sensed a perforated tape which had a row of small "feed holes" down its center line, and larger "code holes" on either side of them. When the code holes were sensed, the "dots" and "dashes" would be emitted to the telegraph line.

10. Edward Kleinschmidt, one of the later contributors, developed a keyboard operated tape punch for the automatic Morse tape systems, and this was manufactured by Teletype for many years.

11. Our wall captions now get around to Samuel Finley Breese Morse,...

12. ...while the next panel records the contributions of House, Hughes and Phelps.

13. Next we find the Baudot Telegraph System given prominent display. Baudot contributed the "equal length" code to the art, using a constant five-current-impulses-per-character instead of the variable dots and dashes of the Morse code. In each impulse, two conditions, current (MARK) or no-current (SPACE) are present. Two impulses (later called "bits.") give four conditions, three give eight, four give 16 and all five allow 32 different characters to be sent. With 26 combinations needed for the alphabet, the others are used for SPACES between words, the SHIFT and UNSHIFT functions to get another case for numerals and punctuations, and the CARRIAGE RETURN and LINE FEED functiuons on page printers. This leaves one extra, the BLANK or all "no-current" combination which can be used for tape feed-out between messages, etc.

14. Baudot made a Tape Reader for his system, shown here.

15. And his typewheel style Printer was widely used in Europe. Its general design was used in a later Teletype product, the Model 11. Actually, his form of five-level code was applied to the French lang- uage, and the form we use and call "Baudot" was really developed by an Englishman named Murray for the English language.

16. Murray is listed among the late 1800's developers, along with Wright, Rowland, Buckingham and Barclay.

17. Barclay was represented in the Museum display by one of his printer mechanisms, but little is known about it.

18. The beginnings of the Teletype story occurred about 1901, when a young man named Prank Pearne came to Chicago to try to get support for the development ofhis ideas for a printing telegraph and Lino- type operating system. The story is recorded in a photocopy of a page from the Chicago Tribune dated Sunday, March 3, 1901 where Pearne is shown operating his system using a modified typewriter. He secured the suppport of Joy Morton of the Morton Salt Company and went to work with Charles Krum of the Western Cold Storage Company, a Morton interest. (See THE EARLY YEARS OF TELETYPE DEVELOPMENT - A PATENT HISTORY for futher details of technical developments.)

19. Pearne's typewriter was apparently a Remington No. 6, one of which has been preserved. He connected electromagnets to the mechanism, so it became an automatic printer at the receiving end of a telegraph line.

20. The printed copy was not immediately visible when recorded. The carriage had to be rotated upward to read it, since the printing was accomplished by "upward" strokes of the typebars which impacted the ribbon against the paper that was on the under side of the platen.

21. Evidence of the early work of Krum and Pearne is given by a keyboard operated device with the title THE KRUM-PEARNE TELEGRATYPE inscribed on it. A relay bank was mounted behind the unit, and one of the typewriters of this vintage was apparently mounted on top of it.

22. Some of the mechanism appears very modern, including the use of code bars to set up transmitting contacts. The later history of the unit is intriguing. The writer found it in storage at the Teletype Wrightwood plant in Chicago in the 1950's. Painted solid black, it was not readily identifiable. However, a bit of the gold legend showed where the black paint had flaked off, so we scratched off more of the paint, gradually exposing the complete legend. It appears that this was the first joint effort of Krum and Pearne. While the legend says "Patent Applied for" no patents appear to have been issued on it directly. Instead, when Pearne broke off his relation with Krum, the latter seems to have kept and used it as a "test bed" for further experimental work, painting it black to cover up the evidence of the earlier connection. Several years later Krum filed applications and was granted patents on the Keyboard arrangement found in the model.

23. Charles Krum continued his work on experimenting with electrical circuits and controls, and

on design of printing telegraph sets making use of commercial typewriters. He was joined by his son Howard in 1906, and such progress was made that the Morkrum Company was formed the next year, using MORton family financing and KRUM engineering.

24. The first full experimental set assembled by the Krums consisted of a relay bank attached to a modified Oliver typewriter, which was one of the most popular machines of the day.

25. The relay bank served the line functions of transmission and recep- tion of telegraph signals which consisted of five impulse intervals, the first and last of which defined character limits. The middle three could be either positive or negative polarity, and one of two strengths, thus giving 64 character permutations. When a character had been received, it was decoded through another group of relays, in what we now call a "Christmas Tree" pattern. Many of the individual relays were designed by Charles Krum and he had been granted patents on them.

26. The Oliver typewriter used has been preserved, with one exception-- someone stole the platen from it many years ago!! It was modified by having an enlarged cast iron base, and was supplied with a larger sub- base that was not required by the original manual typewriter. The keylevers were still attached directly to the typebars, which consisted of "U" shaped members located above and to each side of the printing point. When a keylever was depressed, the typebar rotated sideways and down, impacting the ribbon and paper which were facing upward at this point. The platen moved sideways for character spacing and line return. It also moved forward and back to give three "cases" of printing, CAP- ITALS, LOWER case and FIGURES (punctuations). Thus, each type bar had three characters on its type pallet. The whole arrangement was somewhat clumsy, and the operating speed was very slow.

27. The keylevers were modified in two ways. First, levers were attached which hung down into the sub-base area, providing connections to a bank of electromagnets located in the sub-base.

28. Here the magnets are shown, with the finger pointing to an armature extension which would engage a corresponding hanging lever. Operation of the magnet would pull the keylever down (just as a finger would push it down from above), causing the printing of that character.

29. A set of transmitting code bars were in front of the receiving mag- nets. These worked in conjunction with plates with square notches that were attached to the various keylevers, each plate being coded with notches in its special permutation. The code bars in turn caused the opening and closing of electrical contacts that were sensed during the transmission function.

30. Further front was a transversely mounted "Universal Bar" that rotated each time a character was being sent. It locked the keylevers in their positions during the sending interval, by going over or under small hor- izontal projections on the keylevers.

31. The Krums soon found that commercial typewriters were not rugged enough for continuous use as telegraph printers. They accordingly studied typewriter mechanisms and then designed their own parts to the required standards. (This held true in general in succeeding years, except for one variation--the Model 12 printer.)

32. The typewriter chosen for emulation was called the Blickensderfer. It was quite popular, especially since it had advanced beyond manual oper- ation with one model being motor driven--the first Electric Typewriter!!

33. Printing was by a typewheel mounted on a vertical shaft, and having three rows of type on its periphery. The wheel was raised to match the desired "case", and rotated to the selected character position. It was then swung toward the paper, contacting an inked felt roller which put ink on the typeface. The roller was then pushed out of the way as the wheel impacted the paper, printing the character. During the stroke the wheel was locked into position by having a notched gear underneat it encounter a "corrector" blade that entered the proper narrow notch.

34. The Krums had also come up with the "Start-Stop" idea of character synchronization, and they proceeded with intense development of it.

35. The idea was to have just one polarity of signaling, and one strength of current. Also code impulses were to be contiguous, not separate as in earlier systems, and the "no-current" condition would also be used as a START signal, causing the receiving device to look for received code impulses as they were being generated by the transmitter. The character would end with a "current" condition, called STOP. Thus absolutely pre- cise timing would not be required, since corrections were being made with each character. The initial product line using the method was the BLUE CODE first sold to the Postal Telegraph Company, no models of which have been preserved.

36. The next products were very similar and were called GREEN CODE for the color of paint used on them. (Postal Telegraph's color was blue while Western Union, for whom the next line was developed, used an olive drab, or "green" color.) A Green Code Printer and Keyboard Perforator have been kept.

37. The perforator, called a GPE (Green code PErforator) was designed about 1913 and continued to be produced for the next 50 years, a corporate record. It was magnet driven, and was very fast, being a "work horse" during two World Wars and the intervening Expansion and Depression eras.

38. The Blue Code Printer had three rows of type, like the old typewriter. The Green Code had only two rows, CAPITALS and FIGURES/Punctuations. (It appears Western Union did not want the lower case alphabet, prefering capitals only as being more efficient of operator's and transmission time.) It can be seen that the typewriter mechanism was almost exactly duplica- ted, down to the felt inking roller, except that the paper was now station- ary and the typewheel moved back and forth across the page on a carriage.

39. Tape that was prepared on the Perforator was transmitted by a Reader- Distributor unit, which also contained a Receiving Distributor. The unit is shown here in its normal position, between the GPE and the Printer.

40. This closer view shows how the tape came out of the Perforator and went through the reading portion of the transmitting unit. The sensing was actually on a "drag" basis, with sensing fingers

riding on top of the tape and entering the code holes as the latter passed under them. This in turn closed electrical contacts which were in series with the sending distributor. The line of code holes was not exactly perpendicular to the center line of the tape, a slight "tilt" allowing sequential reading.

41. The Distributor was a brush and commutator type, with the segments consisting of round "button" contacts--not the square or rectangular ones used later. (Apparently the round ones were cheaper to make!!) A motor drove the distributor, through friction clutches. The Receiving Distributor was on a parallel shaft, driven by the same motor. It had smaller round buttons which allowed detection of received code impulses at their most reliable points--near their centers. And it had a "range- finder" system of rotating the faceplate back and forth to find the best point for operation.

42. An interesting feature of the set is a "flyball" type of motor governor with associated contact that regulated the motor speed.

43. the next product to be developed was the Model 11. It was faster than the BLUE and GREEN CODE unit, but not by much, being about 45 words-per-minute.

44. Here it is with its cover closed...

45. ...and now with the cover open. It was a Tape Printer, with the tape being gummed on the back side so that it could be pasted onto a telegram blank. Various types of moisteners were used, each having a container of water and a felt wick.

46. One feature first developed for the Model 11 was that of "cushioned" keytops, which had small springs inside them. The tops were also of soft material, and the combination had a good "feel" according to the typists using the keyboard. This feature was carried over to many later Models during the succeeding years, until replaced by cheaper molded plastic.

47. Another new feature was the motor driven "cam-and-contacts" type of sending distributor which took the place of the "brushes-and-faceplate" type. This too was carried over to many succeeding Models.

48. And the Governor began to look like later versions, but the control was still on the outside, with an adjusting screw giving precise settings. White dots on the periphery of the Governor were now used in conjunction with vibrating tuning forks to set the Motor speed.

49. The Governor had heavy weights within it, their positions during rota- tion being transferred to a plunger on the shaft axis for working the ex- ternal contact.

50. Next came the Model 12, which used commercial typewriter sub-assem- blies as was noted before. Typewriter manufacturers L. C. Smith and Wood- stock contributed the platen and type-basket components.

51. The Printer was of the moving platen type, and always seemed to have problems with paper

feeding. The Roll of paper was hung at the rear, and the "web" of paper coming off it was passed down under a "guide bar" to strip it from the roll and steer it up to the constantly moving carriage.

52. Separate motors powered the typing Unit and the Distributor Unit that was used for Start-Stop service. the Typing Unit contained latching relays that accepted signals from the Start-Stop or a Multiplex Receiving Distributor.

53. This well preserved Model 12 Start-Stop Set was used by the Chicago Police Department for some 35 years before being retired in favor of new Model 28 equipment. A Power supply for furnishing DC to the Set circuits occupies the shelf under the table top.

54. A close-up with the Set cover open shows the two distributors. The Sending Distributor is the familiar Cam and Contacts type.

55. Surprise!! So is the Receiving Distributor! But with a difference --instead of being closed for the full length of its code pulse, a con- tact closes only briefly during the center of the pulse interval, thus making the selection at the most reliable point.

56. The multiplexing of telegraph signals, that is sending two or more messages simultaneously, has a long history--in fact an inventor named Moses Farmer had a patent on such a system granted in the 1850's.

57. The unit shown is a Western Union Multiplex sending/receiving distrib- utor utilizing the "brush and segments" principle. It could be two-, three- or four-channels, depending on the selection of the "faceplate." The Morkrum Multiplex differed by using motor-driven rotating "cams and contacts" in its distributors.

58. Both types of "Muxes" were driven by Tuning Forks, one of which is shown here. In fact, Howard Krum and J. O. Carr of Morkrum got the basic patent on this type of drive in 1930. As the Fork vibrated, it fed alt- ernating pulses to the windings of the synchronous motors driving the rotating brushes or cams.

59. The Western Electric Company made a complete line of printing tele- graph equpment, using designs provided by the Bell Telephone Laborator- ies and their predecessor, the W. E. Research and Development Dept. (And while not generally known, AT&T owned Wetern Union during World War I, and was forced to "spin it off" to maintain competition!)

60. One Western Electric product was the 1-A Printer, a model of which has been preserved. It was electrically operated, being controlled by relays and powered by magnets.

61. Its printing element was a small typewheel mounted on a vertical axis. The tag indicates that the unit came from a Rockford newspaper after many years of usage.

62. We now come to an interesting era of printing telegraph development. The name on the wall chart is POTTS. Dr. Louis Potts was a most pro- lific inventor in the first half of the 20th

century, with almost 200 patents granted. He came to Teletype after the acquisition of the Company by Western Electric in 1930.

63. He had earlier designed this Page Printer which used many unique principles, but had never gotten it into production. The printing ele- ment is a typewheel mounted on a horizontal axis which moves back and forth in front of the stationary paper.

64. Dr., Potts anticipated the need for more efficient handling of messages at a time when most were being manually relayed from office to office. His solution was to have the SHIFTed "F" cause the message to be reperforated or switched to an outbound telegraph line at the distant relay point, while the SHIFTed "S" would cause it to be printed out there, so it became a "city copy" that could be delivered by messenger.

65. We now come to the other half of the Morkrum-Kleinschmidt equation. Edward Kleinschmidt was an inventor of the Krum and Potts generation who had his own business in Brooklyn, N. Y., which was a separate city before it became one of New York City's boroughs. He designed and produced a com- peting line of apparatus, and had so many patent conflicts and suits with the Morkrum Company that the two had to merge in the mid-20's in order to get a viable survivor. We have no models of his 3-A or 3-B units. [That last sentence is underlined by hand and followed by a question mark.]

66. A Model 5, entitled "Kleinschmidt Telegraph Typewriter", was much like its predecessors, except that it was a single-magnet type with "pin-barrel" sending and receiving distributors operating on the START-STOP principle. The printing typebasket was stationary while the platen moved from side to side, thus contributing to paper handling problems.

67. All this is explained on the printout being held in front of the unit. (As far as we know the machine was not operable, so the print copy was made on another machine somewhere!)

68. The legends on Kleinschmidt's keys were similar to those on Potts'.

69. The Models 3-A, 3-B and 5 evolved into the Model 21-A, a multi-magnet tape printer that was used in goodly numbers on the Multiplex systems of the post-World War I era.

70. It was entirely electrical in operation, having selecting and transfer magnets and a solenoid-powered printing and spacing drive.

71. Its relation to the previous printers is easily seen by placing it alongside the No. 5 while lying on its back. The typebaskets are identical, and many other parts are common. This was standard practice all down through the history of printing telegraph apparatus. use what worked already if you could, and invent whatever was not yet available!

72. At the time of the formation of the Morkrum-Kleinschmidt Corporation, Howard Krum and Sterling Morton were collaborating on the development of what became the Model 14. Both men were of the younger generation that had taken over the business! But the new name was so clumsy that after a couple years of suffering, it was changed to Teletype Corporation.

73. The Model 14 was a Motor powered tape printer with some familiar features. These included the cushioned keytops mentioned earlier...

74. ...which are very visible in this closeup. This model had a fraction above the "C", so it was used in brokerage service where stock quotations were in eighths-of-points. And note that the BELL was above the "S", since communication was now direct point-to-point, with no relaying.

75. And here is the cam-and-contacts type of sending distributor which was driven by a sliding ratchet-toothed clutch.

76. The principal innovation was the new single-magnet selector, invented and patented by Howard Krum. The story is that the first sketches were made on a napkin at a Hot Dog stand on Coney Island while on a business trip to New York City. Negotiations became snarled so the conferring group adjourned to the beach for recreation where inspiration suddenly struck Howard!!

77. The single-magnet selector operated code bars that cooperated with "pull-bars" which were part of the type basket. When a character had been received and transferred to the code-bars, the motor operated a semi-circular "printing bail" that moved upward to catch a notch on the selected pull bar, causing the type bar to swing out and down to impact the ribbon against the tape and narrow platen, printing the select- ed character. At the same time, another pull bar was being operated and caused the spacing of the tape on the return stroke. There were two characters on each type bar, with the FIGS SHIFT causing the printing of numbers and punctuations by moving the platen outward the appropriate distance. It was pulled back to normal by the LTRS SHIFT. The Model 14 Typing unit was also called the FP (Fourteen Printer).

78. the governor had internal contacts, with "collector rings" on the outer periphery. Later the collector rings were moved to the end of the device, as shown on this model. The speed could be adjusted while the motor was running, by pushing the small lever next to the motor casting in one case or pushing the upward projecting plate toward the motor in the other. Of course the black and white "target" would be observed through the vibrating tuning fork tine extensions while doing the adjustment, speed being correct when the pattern was stationary.

79. A complete Model 14 Printer Set was donated to Teletype by Illinois Bell. It is in perfect condition, having been given only moderate use by oeprators and wire chiefs on TWX circuits. (TWX stands for Teletype- Writer eXchange service, and was a manual telegraph system that parallel- ed telephone service, on a point-to-point two-way basis.) The Set inclu- des a table with a Power Supply on a shelf under the Printer.

80. A closeup shows a special dial with pointer projecting through the cover. This was used in taking "ranges" as a distant customer or repair- man transmitted to the central office while making adjustments or trouble shooting. And here's that security problem again--the handle for working the ranging apparatus is missing!! Only the shaft shows by the lower hand!

81. The Model 14 line was expanded by taking standard parts assemblies and adding new ones to

provide new components for punched tape systems. The Non-typing Reperforator, called an "RPE" was one such unit.

82. This unit punched tape much like the old GPE but did so in response to received telegraph signals. (One version of the GPE did the same thing but did not get into production.) The RPE unit had its tape supply on top, in line with a tape punching block...

83. ...shown here. Since the punch pins moved upward to penetrate the tape, a chad carrying "chute" was required, which allowed the chad to be moved upward and sideways before falling down into a collection box below. The lever projecting upward at the left was a back-spacing control, used by the operator if a mistake had been made that was to be cancelled by over-punching with "rubouts" (the all-MARK combination).

84. Here is the chad collecting box, mounted below and behind the punch assembly. And at the lower front...

85. ...is the single magnet selector assembly, taken without change from the Model 14 Printer Unit. It was mounted in a vertical position, however.

86. Another component of the punched tape line was the Model 14 Transmit- ter Distributor, also called the XD.

87. This was a Tape Reader, modified from its use with the Morkrum Multi- plex, where it was magnet driven, to be stepped by a motor. The distrib- utor was a rotating-brush-and-segmented-ring type, also driven by the motor through a felt clutch. Note that the motor is now a synchronous type. These came into use after the power company stabilized the frequency of the power system so that electric clocks would keep good time. This happened in the late 1930's. Henceforth governed motors would be needed only on uncontrolled AC or on DC, which was still common.

88. The Model 14 Printer unit was worked over to become a Typing Reper- forator through the addition of an RPE Punch Block via which holes were punched in wide tape some six character positions to the left of the printing point. Also the holes were not completely punched out, the chads hanging by "hinges" at their left edges, allowing the printing to be retained and read by the telegraph operators. This was the basis of "torn-tape" sys- tems developed for Postal Telegraph and military organizations during World War II. The Typing Reperf. was called an "FPR" (Fourteen Printing Reperforator--A Reperforator makes tape from received line signals, while a Perforator makes tape from manually keyboarded input).

89. One step further was the Typing Reperforator Transmitter-Distributor. It was a Model 14 Typing Reperforator modified so that the last char- acter punched actually appeared in the tape outside of the punch block. As tape was punched, a tape loop was formed by a depressing lever, hanging down and passing through a slot into a tape collector under the table or shelf on which the unit was mounted. It was called an "FRXD".

90. To the left of the punch was a "Climbing Transmitter" which was a very narrow mechanism

that was pivoted at its lower end. When an outward connection was made, the Transmitter began reading the punched message, sending to the distant receiving point. The dangling loop of punched tape, if present, was gradually used up, and if no further message was available, the Reader pivoted and "walked" its way along the tape toward the punch block until it sensed the last character punched and stopped. This unit had only a short product life, being obsoleted by other less cumbersome switching systems that used electronic message handling means.

91. We now come to the Model 15 line, which was to become the principal product of Teletype Corporation for many years. The first components were being developed in the late 1920's...

92. ...so that on October 1, 1930 the company was purchased by AT&T in order to get manufacturing control of the new product line which was to be used in the emerging TWX service that was offered the next year. Teletype was assigned as a subsidiary of the Western Electric Company, and so could be considered to be an adopted "step-daughter" of "Ma Bell."

93. The principal product in the Model 15 line was the Page Printer. No such unit was displayed in the museum, but the Model 19 had the same printer components, and will serve to describe its features. The Printer was a stationary paper, moving typebasket type in which the basket from the Model 14 was used. The M15 printer was called a "BP" for "Bell Printer."

94. The type basket was laid on its back and moved back and forth in front of the paper on rollers that rode on horizontal "rails". The code selec- tions made by the Selector were transferred to horizontal "vanes" below the front rail which were rotated up or down in accordance with the MARKs or SPACEs of the code pulses. Levers then transferred the code combinations to the code bars on the type basket. A printing "bail" (the two parallel blades to the rear of the pointing finger) then moved forward, causing the front end of the selected typebar to swing up and impact the ribbon and paper, printing the character, and then moving the basket one character to the right. The platen was moved up or down for FIGS and LTRS case SHIFTs.

95. The conventional single-magnet selector was used, mounted vertically as in the RPE. Earlier selector magnet assemblies were of the "pulling magnet" type, in which the power derived from the signal line current (or from a "local" relay contact circuit) provided the selection effort. This printer has a "holding magnet" type selector, in which the power was supplied by the motor driven selector cam which pushed the magnet armature to the operated position between selection intervals, then allowed it to release if the line was in the SPACING condition. This relieved the line or local current source from providing appreciable power.

96. The asociated Keyboard was a "plug-in" unit that mounted under the Printer unit. Called a "BK", it used the conventional "cushioned" keytops, and most parts were from the Model 14.

97. Transmission was from a "cam-and-contacts" type distributor that was similar to the M14. This particular keyboard has auxiliary contacts mounted above the distributor.

98. A complete Model 15 Set has been preserved. It was one of the mili- tary models manufactured during World War II, and was used extensively throughout that conflict. Teletype worked "around-the-clock" making them!

99. The Model 19 was a variation of the Model 15, differing in that the Keyboard unit included a Tape Punch and a line character counter. These were provided so that simultaneous punching and set transmission could take place, the latter being from a tape reader with the Printer copying output.

100. The Reader was an XD unit which was located oat the left side of the table top on which the Set was mounted. The particular Set on display was donated to the Museum by Illinois Bell upon being retired from service when replaced by more modern equipment. The Tape Punch and Character Counter are quite evident. A Power Supply occupied a shelf in the back of the table. The Keyboard-Perforator-Counter Unit was called a "PEX".

101. Another variation of the Model 15 was the Teletypesetter Perforator which was designed and produced for the Printing Trades.

102. The Teletypesetter Perforator had four rows of character keys and punched extra wide tape with six code holes. Six level code provided for transmission of both Upper and Lower cases, as required for newspaper and book printing. Other characters were included, and the character coun- ter mounted to the right rear allowed the typist to keep track of how many charcters had been punched and what accumulated number of proportional width spaces had been utilized. (The character widths varied to give the best appearing copy when typeset, in the printing trades.)

103. A "pin-barrel" Selector at the left side of the unit provided special typesetting controls. The punched tape was sensed by a six-level XD unit, and the line signals then sent were reperforated at the distant end of the telegraph circuit. The resulting tape was used to run a Linotype machine within a print shop, via a Teletypesetter Control unit that was also made by Teletype at first, and then by Teletypesetter Corporation after the latter had been "spun-off" from Teletype. Several years later "setter" was sold to the Fairchild newspaper interests.

104. A version of the Model 15 Page Printer was manufactured for use with the Teletypesetter system. This was the Model 20, using the six-level code. It printed both upper and lower cases at a constant ten-characters- per-inch, thus giving editors a printed copy of each message sent that could be used in their work. Since it did not have proportional spacing, the copy was not exactly like what the Linotype would produce, however.

105. Another outgrowth of the Model 15 line was the Sequential Selector. Switching of messages was becoming common, using sequences of charcters preceding or embedded in the messages, and code detecting contacts were being added to the selector/printing mechanisms.

106. When the mechanisms became too cumbersome, a separate selector unit was designed, the sole purpose of which was to detect the sequences and cause the switching action to take place. The government's Federal Aviation Agency was the principal user, on weather reporting networks.

107. When the Model 15 turned out to be a heavy duty machine, capable of working 24 hours a

day for many months between maintenance calls, the thought of producing a lower cost light-duty machine arose. The first version was called a Model 24. It used a new variety of typewheel and stor- ed each charcter after selection, the printing-out not occurring until the next character was being received.

108. This was slow and inefficient, so the design was changed to give "overlap" with printout occurring immediately after selection, and inde- pendent of the next character's arrival. The new unit was called the Model 26.

109. The usual Model 14 Selector mechanism was used, mounted at the top front of the Printer unit...

110. ...while the common "Cam-and-Contacts" sending distributor was there too. "Cushioned Keytops" were present also, seen at the lower right hand corner.

111. The Typewheel was a rotating wheel in which Type Pallets were mounted in such manner that when the selected Pallet was in position between a Printing Lever and the ribbon-paper-platen area, the Lever could push it back toward them with the impact printing the charcter.

112. The Model 26, in one version, was the first integrated ASR (Automatic Send-Receive) set designed by Teletype. A Tape Punch was located at the top right hand side of the printing unit...

113. ...while a corresponding Tape Reader was located at the lower right side of the set. (Teletype never did design both Punch and Reader into the Model 15 Printer Unit, but the Lorenz Company of Germany did, after Teletype had sold them patent and manufacturing rights in the 1930's. And the Ger- mans then used them in their military communications during World War II! It was not until the 1960's with the Model 32/33 that Teletype made a unit- ized ASR Set!)

114. A well preserved Model 26 KSR Set was donated to the Museum by Illi- nois Bell, complete with a small table typical of those provided for use in a customer's office. Only a few thousand were made, since the manufac- turing costs were found to not be much less than for the Model 15, and the services provided were limited. One serious problem was the moving carri-age platen, giving paper feeding difficulties.

115. Work on an eventual replacement for the Model 15 began while the war raged overseas. Called the Model 28, it was to be made up of predes- igned "Building Blocks" that could be assembled into various configurations. Advantage was to be taken of new materials, manufacturing tools and meth- ods and other new technological ideas.

116. Each version was given a code letter as it came along, with Model "A" being followed by Models "B" and "C".

117. The last one named has been preserved and has a number of interesting features.

118. The "Cam-and-Contacts" sending distributor was still used, but the cam was now made of molded bakelite plastic.

119. And molded plastic keytops were used for the first time. We don't know the reaction of the operators who were used to the old "cushioned" type, but the cost of the plastic style was much less and carried the day!

120. Printing was now accomplished from a "Type Sector", a curved arc of metal with the typefaces projecting from its outer surface. the Sector was raised up to select a row of type for printing, then rotated to right or left to the chosen charcter. A "Printing Bail" behind the paper then moved forward, impacting the paper against the ribbon and typeface. We will see the "sector" again when we come to the Model 31.

121. The Model 28 proceeded on through the "D", "E" and "F" stages.

122. The Model "D" ahs been preserved, and shows evidence of being rel- ated to the final M28 production design. A "Typebox" moves horizontally across the paper on a carriage riding on a "rail".

123. A single-magnet selector is used, having a large coil. The range finder looks somewhat like the old M14 one.

124. The printing Carriage is moved back and forth across the page by being attached to "spacing Drums" via steel cables. Above and behind the rail on which the carriage rides, flat steel belts like clock springs were used to move the typebox back and forth in character selection. In later models the belts were replaced by more steel cables. the Spacing Drums were much like the same elements on conventional typewriters, ex- cept that they were much larger.

125. Here is a view of the first typebox. It was fastened in place with screws, but otherwise much like the ones that went into productin. The pallets were mounted between front and back plates, with springs on the bodies of the pallets providing retraction after being impacted during the print operation. the print hammer moved character-space by character-space across the page, while the typebox moved horizontally and vertically to bring the selected character into the printing position, after which the hammer was released to impact the pallet "stem" and print the character. The impact power was from a stretched spring, with a "thumb-screw" at the front giving variation in pmpact power when various numbers of carbon copies would need to be printed.

126. One main feature was the use of a metal "drum-and-movable-shoes" type of clutch for driving rotating parts. These were miniature versions of the common automotive braking system, used in reverse. Here one is seen driving the typebox positioning mechanism. Two serious problems were encoun- tered in their development. Breakage of drums due to the extreme pressures involved was cured by the use of "LaSalle Stress-Proof Steel" per a study made by Armour Research. And gradual appearance of "slippage" due to the accumulation of wear products was alleviated by cutting crosswise slots into the drum working face, thereby letting the particles drop out of the way instead of getting imbedded in the working surfaces. Walt Zenner got the patent on this, as well as on most of the other mechanisms developed for the Model 28.

127. This view of the back of the Model "D" shows the Selector Clutch that was tripped by the START pulse of the line signal. The Selector Magnet is just beyond the pointing finger.

128. Here is a production M28 typing Unit mounted on a Base. It is a late version with a Tape Punch attached at the left for use in an ASR Set.

129. The production model Single-Magnet Selector had a radically differ- ently appearing mechanism, but the function was the same as in the old M14 and its followers. The range finder assembly was entirely new, and was easy to use compared to the older ones. The clutch drum hung "out-board" of the selector itself.

130. The print hammer and typebox carriage components were mounted on a "Front Frame" assembly that could be easily detached and reattached in trouble shooting. And the steel cables are now quite visible.

131. The print hammer has been "beefed-up" with additional mass, so as to have a greater impact during the printing operation. A "U" shaped guide notch has been placed just in front of the point where the hammer will strike the ribbon against the paper at the end of the stroke. And the thumb screw for adjusting print spring tension has been replaced by notches and a cooperating lever in front of and below the hammer.

132. The typebox is easily removed from the carriage, just by flipping a retaining lever which has "over-centering". The pallet faces have the various charcters in reverse, of course, and are also made concave from top to bottom to match the contour of the platen, thus giving even density of printing over the whole character.

133. The back side of the typebox shows the "stems" of the type pallets projecting out from the back plate. This is the side seen when the box is mounted in place. The round stud projecting at the right end is used as a handle when installing or removing the box from its mounted position.

134. Within the typing unit, a "Function Box" (also called "Stunt Box" because of the many diverse functions it can supply) is mounted horizon- tally. It cooperates with "code Bars" mounted parallel with it. This unit provides the LINE FEED, CARRIAGE RETURN, BELL signal, and selective calling function operations. Electrical Contacts may be mounted on its top and are operated according to received signalling characters or se- quences.

135. The Keyboard has molded plastic keytops that come in various colors. The red ones at the top provide various local operations, while the green ones below are used in sending messages.

136. And a cam driven single contact in a metal box provides the Sending Distributor function. This made it easy to add filters to suppress radio interference, which had become a problem in recent years.

137. The Typing Reperforator is an independent unit that is powered by a common motor in the M28 Set. It provides punched and printed tape for the same purposes that the old M14 FPR Unit did. the legend should be LPR, and it appears the "R" has dropped off the card. (The M28 typing

Unit was called an "LP".)

138. The new M28 Single-Magnet Selector is used, of course. Behind the hand, the printer ribbon spools may be seen. The tape punches were at the lower left.

139. Typing was by a small typewheel which was a cylinder with four rows of typefaces on it. A single print hammer was located under the wheel and was driven upward, impacting the tape up against the ribbon and typeface selected. Early models had chadless perforations, with "square" chads, while later ones printed the characters between the feed holes in the center of the tape. These characters were somewhat smaller than those printed on top of the chads.

140. A complete Model 28 ASR Set was on display in the Museum. It contain- ed a Typing Unit, A Keyboard, a Typing Perforator (not Reperf.), a Tape Reader and had room behind the latter for the mounting of an independent Typing Reperforator. If the Typing Perforator, attached to the Keyboard, needed a Printer assembly, it was just added above the Punch.

[is there something missing here? gil smith]

201. [Note numbering changed due to entering second carousel.] A six-unit code model was developed, to replace the M20 in Teletypesetter use. It never went into production, however. It was called the Model 29.

202. And a Model 28 Typing Unit was mounted in a tight-fitting box for use in the brokerage and news bulletin business. It, too, did not catch on!

203. There was always the push to develop lower cost units for simpler systems. One such system was the Model 36 Monopulse.

204. This oeprated much like some early stock tickers, with the line signal being an OPEN interval during which sending and receiving devices rotated until the proper point was reached for printing the desired character. the Keyboard, at the left here, had its Keys mounted in a circle, which was non-standard and took a bit of training by the operator. The sending con- tact was opened by depressing a key, and remained open until the selecting arm reached that key after leaving its rest of STOP position.

205. Meanwhile, the selecting arm at the receiving Printer was similarly seeking the printing point. When the line closed, it was there, so the printing hammer struck the rotating typewheel, printing the character. The Printer typewheel was inked, much as the old BLUE and GREEN code printers had been. The inking roller can be seen at the top of the printer, with the typewheel under it. then comes the printing tape, the supply roll of which is at the bottom. The printing hammer is just under the tape and print wheel, and moves upward to cause printing. The system was very simple and therefore low cost, but only a limited number were made.

206. The Museum contained a number of other simple, low cost printing units that were built and studied over a 25 or 30 year interval.

207. One of these was a so-called "Portable Printer" that could be carried around in a small case much like a Portable Typewriter, except that this was before the day of aluminum and magnesium castings so it was very heavy, almost 40 pounds.

208. It had the usual M14 selector mechanism...

209. ...and the green colored cushioned keytops.

210. Also the conventional "Cam-and-Contacts" sending distributor.

211. The unique thing, though, was the "Daisy Petal" style of typewheel, the first unit known to have this design. The wheel rotated to the desired character, after which a printing hammer impacted a "Petal" which had the typeface on its back side. The latter was driven against the ribbon and paper, coming to rest against the platen. The rinter could carry only a small supply roll of paper, which folded down to be just above the keyboard when the unit was put into its carrying case.

212. One outgrowth of the Model 28 development work was the Model 31. This was a light weight Keyboard Send-Receive Tape Printer Set that was used for sporting events where it superseded the old Morse Key and Oper- ator method of giving play-by-play descriptions and sending press dispat- ches.

213. It had a single-magnet selector of a simplified type with a rudimen- tary range finder.

214. The Keytops were molded plastic, and were actually the prototypes for the Model 28 production design when that came along a few years later.

215. The usual "Cam-and-Contacts" signal generator was used, and here the molded bakelite cam was proven in.

216. The typing was from the "Type Sector" studied on the early Model 28 unit. It was turned over, with the convex surface down, and its mounting was fixed, not on a moving carriage. The Sector had four rows of type- faces, so moved out the proper distance for a desired row, then rotated to left or right to select the desired character. The production version Sector was also molded Bakelite, which was found to be adequate for light duty but failed under severe service when tried in later printers. Printing was by a print hammer located under the tape, which was swung upward, push- ing the tape against the ribbon and typeface.

217. Next came the Model 32/33, the respective sets for five-and eight- level codes. The need for upper and lower case character communications was coming to the fore, especially with computers coming into common use. The ASCII eight-level code was approved about this time, with John Auwaer- ter of Teletype being the principal proponent. The TWX network was

convert- ed to dial on the DDD (Direct Distance Dialing) Telephone network, and eight-level service was required.

218. The Model 32, shown here, was the five-level set which was used in large numbers for Telex service world-wide. Most are still in service, after some 20 years. It was available in the ASR Set, with Punch and Tape Reader at the left side, or the tape units could be left off, giving a simple KSR set.

219. The Printer has a Single-Magnet Selector, with a low impedance selector magnet that operated on 500 milliamperes of current, some 10-25 times more than had been used up to this time. the range finder for the selector is below the hand in the view shown.

220. Since the M32 and M32 were to be very low cost, mechanisms were quite simple. A "Brush-and-Commutator" type Sending Distributor was used, mounted at the right side of the Typing Unit. Printing was by a small type cylinder (shades of the BLUE and GREEN codes!!), which moved back and forth across the paper, which was stationary. Weaknesses in design were gradually upgraded so that the M32 and M33 were eventually known as "Standard Duty" Sets, and not "Light Duty".

221. A "Call Control Unit" was mounted to the right of the typing Unit, and served to make connections to signal ines and to provide other neces- sary functions.

222. The Selector Magnet was driven by a "Selector Magnet Driver" which caused the magnet currents to rise and fall rapidly, giving better margins of operation than the older "pulling magnet" or "holding magnet" selectors had done. The SMD is the upright card marked 161604, and the power trans- sistor does the actual current switching.

223. Over a half-million Model 32's and 33's had been made by 1975, and the 500,000th was plated with gold and placed on special exhibit. And another 100,000 were made in the next 18 months, so that No. 600,000 was painted red-white-and-blue and shown around the country during the last part of, and the year after, the Bi-Centennial year.

224. Meanwhile, the Model 28 had been upgraded into eight-level service and the new version was called the Model 35. A Model 34 five-level was also tried but did not go into production. however the need for upper- and lower- case service continued, and the Models 33 and 35 were CAPITALS only. Thus work began on a new set designated Model 37. This was to supersede the electrical typewriters that were beginning to be used as printer terminals. It had to work at 150 words-per-minute, compared to the 100 wpm. of the M33 and M35.

225. The M28/35 typebox was enlarged with two additional rows of pallets for the lower case alphabet, and the printing hammer mechanism was changed. This experimental model shows some new mechanisms in development.

226. The Single-Magnet Selector with SMD drive was standard, and some other mechanisms were taken over from the M35.

227. The principal difference was how the typebox positioning was accom- plished, since this had to be 50% faster than before. New power drives were worked out.

228. An "Aggregate Motion" mechanism was developed for the positioning, and was assembled into the right side of the typing unit. This worked very successfully at 150 wpm.

229. The Model 37 was restyled from the M35 and was nice appearing. How- ever, it did not "catch-on" in the market and soon was discontinued in manufacture. A Model 38 (eight-level M33) was also tried and failed.

230. One unit was placed in a "Skin Tight" cover and topped a pedestal. This RO (Receive-Only) M37 apparently did not get into production.

231. A derivation of the Model 37 was a new Stock Ticker. The faster speed was very attractive to a market where no new equipment had been developed or gone into production for many years.

232. The aggregate motion mechnism for positioning the typebox during printing was laid down flat, with the box coming above the wide tape used in the Stock Market Quotation business. A standard ribbon was used.

233. The Typing Unit was housed in an attractive cover, marked with the name of the service provider, in this case the New York Stock Exchange.

234. Where a table was not available to put the unit on, a companion pedestal could be supplied.

235. Since we are talking about Stock Tickers, perhaps we should get into some of their history. Two very old versions had been donated to the Teletype Museum.

236. The first is one invented by Thomas Alva Edison. It is covered by a glass bowl, a common use where instant visibility of copy was essential.

237. With the cover removed, the typewheel is visible. It was inked by a felt roller that was carried in a box above the typewheel.

238. From the back, the mechanism can be seen. Operation was from an escapement mechanism that was related to a clockworks. Local power was from a hand would clock spring, or possibly a depending weight.

239. The other Ticker is a New York Stock Quotation Co. variety, also with the glass bowl overhead.

240. Its mechanism was different. The principle was similar to the Mono- pulse, with the line being opened at the beginning of a character trans- mission, and closing at the proper instant for printing the selected character. The power for printing came from the line current pulse that then appeared.

241. Teletype developed stock tickers well after the others had appeared. Two models are on display.

242. One is the Morkrum "High Speed" Ticker which appeared in the 1920's. It was the one in service during the prosperous times following World War I, and continued in use until superseded by the Model 37.

243. It used a "Pin-Barrel" type of selector mechanism to which the type- wheel directly attached. Again, the typewheel was inked by a felt roller contained in a box above the wheel.

244. A faster design than the Morkrum Ticker was developed to be a replace- ment. It was called the Model 16, and was a sensation in its day, but only in the laboratory. It occupied a minimum of floor space, and used standard typewriter ribbons.

245. Looking down from the top, the principle is clearly evident. Two banks of typebars are used, located on both sides of the wide tape, which would run from bottom to top in the picture. This allowed very fast prin- ting, much faster than the rather sluggish Morkrum Ticker Printer. But one problem remained--the economic factor. It was brought out at the begin- ning of the great Depresion and there was no market for it. Thus the old Morkrum continued to be used, and a few more units were even produced during the next 30 years or so until the Model 37 Unit came along.

246. We now enter the modern era of Teletype developments, and not all of them represented in the Museum. One model here happens to be the first Model 40 Printing Unit. This had a moving horizontally mounted belt to which printing bars were attached. These were also the armatures of a row of print solenoids that were mounted under the platen at the rear.

247. A close-up shows more details. the typefaces are at the top of the printing bars, and when a print magnet for a particular column was energized at the right time, the printing bar's armature would be attracted to the rear. Since the bar was pivoted at its bottom, the type face at the top would impact the ribbon and paper against the platen, printing the character.

248. The next model turned the type belt up on edge and placed standard M28/35/37 pallets in it in a horizontal position, as in typebox printers.

249. Now, a row of print hammers at the rear of the unit fired at the proper instants to get character selection and printing in the desired column location. The print hammers were found easiest to make with flat faces, so the type pallets were made that way also. Printing was on a "print-through" basis, and copy could not be read until the paper had fed upward a short distance.

250. The first complete unit had a large platen above the printing point for paper feeding purposes only. In other respects, the experimental unit was much like the production design...

251. ...that looked like this. the final unit was quite compact, and was easy to service, change the pallets to another arrangement, etc.

252. Looking up close, we now see a smaller platen for paper feeding, and a simpler, although still circuitous ribbon feeding route. Instructions for the latter task were given on a label pasted on the top frame. This Unit is still in production and selling well.

253. A narrow paper version of the M40 Printer Unit was made for portable and mobile use. It was field tested on one of the new radio-telephone net- works and for police use, but did not catch on and was abandoned.

254. Since the M40 was rather overpowering in its complexity, simpler designs were sought for mobile and portable service. One of these was very compact, mounting easily on the "hump" in the front seat area of police cars.

255. Inside, it had a motor driven "type belt" on which the typefaces were directly molded. The left hand pulley around which the type belt passed, was mounted on an arm that was pivoted at its other end. Printing was accomplished by swinging the arm until the selected typeface on the belt impacted the ribbon against the paper which was wrapped around a platen. The printing mechanism was mounted on a horizontally oscillating carriage, for column selection. This set, also, did not go into production.

256. In the 1960s and 1970s Teletype designed and produced a nubmer of high speed tape units. One of these was the DRPE, a punch that worked at up to 2400 wpm. This was included in a line of equipment titled DATA- SPEED or TELE-SPEED. In the laboratory a DRPE was equipped with an over- head triple bank of magnets attahced to printing wires which dropped down so their ends could impact a ribbon against the punched tape. this caused the printing of full "Dot Matrix" characters on the tape, simulating the output of the old Typing Reperforators. Again, no market!

257. And now for a couple of originally classified items that came out of the old "50 Lab". The first is a tape printer that used a typewheel for the printing function...

258. ...and the second is the Keyboard Send-Receive Unit in which the printer was used. It was a five unit set with scrambling facilities at the top. The Keyboard seems to come from the Model 28. The set is long since obsolete, in these days of electronic chip and CRT developments.

259. Another set developed in the intervening years was the 4210 Magnetic Tape Send-Receive terminal. It was used with the Model 37, for which it was mounted in this special cabinet.

260. The Magnetic Tape was housed in a Cartridge, with a leader extending from it. The cartridge was mounted at the rear, the leader was pulled forward through a slot alongside the recording/reading head, and then was wrapped around a "capstan" on which the spent tape collected as the tape was read or recorded. At the end of the operation, the tape was rewound back into the cartridge. This Set was produced for several years.

261. Another development that was ahead of its time was the Inktronic. The principle was discovered by Charles Winston in the late 1950's, and took several years to get developed. This

Receive-Only Printer operated at 1200 wpm, and cooperated with DATA-SPEED devices. Only a couple thousand were made before it was MD'd. Since then, other manufacturers are turning out similar devices with some commercial success.

262. A Send-Receive Inktronic Set was developed but never put into manuf- acture. It used the console from the CDT (Communications Display Terminal) which was the predecessor to the Model 40 Keyboard-Display Unit. The Key- board came from the Model 37.

263. And now our last set of equipment--a combination CDT and Inktronic that was assembled for market testing purposes. The CDT Tube, Keyboard and Controls are at the left, while the Inktronic Printer Unit occupies the right half of the Cabinet. the Dial and Phone tell us that this Set was intended for Data-Phone Service by the Bell system. In spite of being the first "Hard Copy/Soft Copy" set made, it never got beyond this point in the marketplace.

Our tour of the old museum is now complete. We have not covered all the equipment that is in Museum storage, and the storage does not contain samp- les of all the various types of equipment that were developed down through the years. For example, large Sets, such as the vacuum tube Electronic Multi- plex developed in the late 1940's, were too big to be in either the Museum area or in storage. Many cabinets, such as those that housed multiple sets of Printers, Tape Punches and Readers, etc., just could not be accomodated. But we hope that you have had a good pictorial tour, and have developed an appreciation of the hard work that was done by many engineers and their associates in keeping Teletype at the forefront of progress down through the years. Thank you!

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Document Notes

Note by Jim Haynes: Above document received from Bill Lill 8 Nov 1999. Ran Slayton started at Teletype about 1946, after working for Western Union. He died in 1998.

Editorial comments by Jim Haynes follow:

In my day (mid 1960s) the museum was also regarded as a reference library for the R&D staff. In addition to Teletype products there were some competing products, such as Kleinschmidt and MITE machines and an IBM Selectric typewriter. The following comments are keyed to the numbered paragraphs above.

3. It is now generally accepted that it was Alfred Vail who counted the pieces of type in a printer's shop and designed the dots-and-dashes Morse code.

13. Blank was used in the multiplex systems as a no-character character.

38. And if telegrams are likely to be transmitted by teleprinter and by Morse, there is no need for lower case because Morse doesn't have upper and lower cases. "The paper was now stationary..." is something an in- curable punster cannot fail to notice.

46. I remember a Teletype catalog of keytop arrangements that listed three kinds of keytops: celluloid, spring cushion, and pneumatic. Celluloid keytops were like those of old typewriters. There was a paper disc with the characters printing on it, a celluloid disc to cover the paper, and a shiny ring to hold the discs to the key lever. Almost all of the Western Union machines I ever saw had celluloid keytops. I don't believe I ever saw a pneumatic keytop; I presume it used air instead of a spring to cushion the key press. Personally I tend to prefer the feel of the celluloid keytops over the spring cushion ones. An advantage of the later keytops over the celluloid style is that they permit the whole keyboard to be immersed in cleaning solvent.

72. The "Teletype" name was apparently used before the company name was changed. I have a manual where the front page says Morkrum-Kleinschmidt but there is also the logo of "TELETYPE" on a scroll.

74. I don't think it follows that there was no relaying. Not sure what he means here. The fact is that two basically different arrangements coexisted for a long time: bell on J for Western Union and bell on S for Bell System and U.S. government.

80. I haven't seen one of these range finders, but from a picture I have seen it appears the crank is the same part as the M15 paper crank. Those things are notoriously loss-prone, as they have to be removed to get the cover off the machine.

87. Speed governed motors came in handy in WW-II when it ws possible to adjust motor speed on U.S. machines to get them to interoperate with 50- baud British machines. There was a special tuning fork for the purpose.

90. I wouldn't be so sure about the short product life of the FRXD. Believe it was used in the Bell 81- systems of the 1930s and again in the 81D-1 system post WW-II. I remember seeing a couple of them at an F.A.A. station in the mid 1950s. I further remember seeing in the Teletype factory an LRXD, which was a machine using Model 28 components but physically and electrically interchangeable with the FRXD. I didn't know there was much use of electronics in switching until the late 1950s.

99. There was also a perforator-only version of the Model 19 keyboard, called DPE. It was used as a free-standing perforator replacing the GPE.

105. Western Union used code-sensing contacts mounted above the pull bars on Model 14 printers. The Bell System used similar contacts on FRXD and presumably other machines of the 14 line. Model 15 had a function mechanism, but only a couple of extra slots for operating contacts or other optional features. The Sequential Selector was usually called a SOTUS.

113. There have recently been published some pictures of German Lorenz crypto machines from WWII. A pair of Teletype selectors with range finder dials are plainly visible.

130. And with the "Front Frame" left off the machine could be used as a non-printing sequential selector, replacing the SOTUS.

201. Now the Model 29 that many of us know was the Integrated Data Process- ing ASR set, using IBM BCD code and having two tape readers, one for transmission and one for program control. However it is plausible that Model 29 was also used for the Teletypesetter model, since the code was six-unit in both cases. The Model 29 IDP ASR set was supposedly made for internal Bell System use only, so as not to subject the System to charges of favoritism for accomodating the IBM BCD code in preference to others. However I know some of the typing units at least turned up at General Electric in Phoenix.

202. And there was the "skintight" M28 KSR cabinet made as a tabletop unit for the military, and the M28 wall-mounted printer.

211. And to think Teletype could have had the daisy wheel printer before Diablo and Qume

212. I have a Model 31 in a Western Union travel case. It looks like on mine that the transmitting cam is metal.

224. What was the Model 34? A 28 built into a 35-style cabinet?

231. Note that the Model 37 stock ticker shipped several years before the more general Model 37 set went into production.

252. The Model 40 printers I am familiar with used forms tractors rather than a platen for paper feeding.

256. My understanding is that Data-Speed was the name of a Bell System service, and that the machine was called Tele-Speed if it was made to be sold by Teletype to a non-Bell company.

261. I'm not sure other manufacturers are turning out "similar devices." Here in 1999 there are ink-jet printers galore, but I don't believe they use any of the same principles as the Inktronic.

262. An Inktronic KSR set was produced, because we had one at U.C.S.C. (Maybe we had the only one?!)

This document was formatted by Gil Smith, July 2001. The original file, slayton--tty-museum.txt, is courtesy of Jim Haynes. Sadly, there are no pictures to accompany this wonderful tour.