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The Counterpressure

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—

always increasing

The interchange of menages has by degrees given birth already to a ~~great~~ large number of telegraphlines, which on several roads still prove insufficient, and will do more so, when the tolls are reduced. Although all effort have been made to make the most of the wires, that will lay to forward as many menages as possible on one wire, still this desire now recently has come more and more to the front, and amongst other contrivances, use has been made of the mechanical Tastwriter and the counter, speaker, the last of which since a long time has been extensively been made use off and quite satisfactorily on several lines.

In what is going to follow I intend to have the different ways of countespeaking undergo a closer examination, and especially I am prompted thereto by the perusal of a treatise about counter correspondence written by the late Austrian Superintendent of Telegraphs Kohl in book IV and V, year 1862 of this Journal, on page 82 whereof we find

" The fact that every of the three systems
" of the new double correspondence suggested
" by Kohl, as far as the main subject is
" concerned are put forth in such ~~form~~ a
" shape, as which allows them to be used
" in practice, would prove at the same time
" the correctness of the ~~aforementioned~~ at the very beginning mentioned superiority
" over the hitherto known methods of
" double speaking.

The writer now takes it for granted, that the methods which he believes probably ~~deems~~ novel ones really a better thing is produced than is done by the

methods known up to date; consequently I wish, first of all, to submit the three methods described by Kohl, especially in regard to their value for practical use, to a closer examination.

If we take in hand Table V and examine Scheme I, then, when Station A depresses its key both relays of this Station are affected by the departing current, and attract their armatures, through which the own writing apparatus however does not get into activity. If now ~~simultaneously~~ likewise the Station E depresses its key, and we keep Station A in sight, then the opposite current must destroy the action of the departing current in relay R', through which the armature falls off, and causes the closing of the writing-apparatus. Here it is necessarily understood that the departing as well as the receiving current appear on the Station A with the same face. If now Station A lets loose its key, then

the relay must attract R' and drop R, and suppose for instance that Station E. should send for a long while any current to Station A, for instance when producing a dash, and the latter simultaneously would send several dots, then at the beginning and the end of each dot both relays should work on Station A, in addition to which, during the time, in which the key passes from the battery contact to the resting contact, there is a moment in which the arriving current passes through both relays, and so the signal of the writing apparatus suffers a short interruption, — gets broken off. If even we are able to reduce this difficulty to a minimum by narrowing the contact, nevertheless the surety of telegraphing is impaired by it.

If furthermore now we take in consideration that the arriving and departing currents must be alike, in order to compensate mutually their action in the relay R' (resp r'), which presupposes

an absolute intulation of the lines, and that as a perfect isolation never can be practically obtained, then relay R' must be equally sensitive for the weaker arriving currents, as also for the more powerful arriving currents hence I am of the opinion when adding the just aforementioned disadvantages any practical value should be denied to this scheme of currents.

Exactly the same difficulties we find in scheme II. The doublekey we use in its motion from the resting-contact to the battery contact and inversely undoubtely must interrupt the linecurrents and at the same time also the localcurrents, and is not much fit for repeating arrangements; likewise this Scheme requires an absolutely insulated line. In practice, Scheme II seems likewise to be not applicable.

If we take to Scheme III we find there even greater difficulties; I want to say here that this

arangement is not all novel, but a patent therefor has been granted to me as early as march 1855.

When I refer to the description given by the maker himself we find, that for instance the current, which starts from Station A, thro[ugh] mant pos the appurtenant Relay R, its armature however cannot be attracted owing to the more powerful tention of the Spring. When however the current is increased through the current of the same direction arriving from Station F², then this relay gets attracted, when however the arriving current disappear, then the armature should fall off libewise. This however takes place only then, when the disappearing current, own forming the largest part of the entire Strength of current, as however this never could be the case in practice, so Consequently the armature is kept fast by the remaining current, and will drop off not until the own key drops off. Consequently the attracting of the relay armature R R² according to the idea goes on,

when the same drops off however the practice gives quite a different proportion. Besides there the same difficulties as are mentioned in the schemes I and II are added to it, and hence this scheme as little as the two former ones ever can have any satisfactory practical result.

From the writer's treatise we quote as the difficulties of the former methods for counter. speaking.

1 A peculiar constructed relay has to be constructed and its subtile regulating should only be done by such operators, as are perfectly familiar with double correspondence.

2 That the lines, with regard to insulation should in a fair condition and so forth

As far as the first point is concerned, I can not see, how it is possible to call an ordinary or a polarized relay with doublewire, without regard to Edlund's relay, — "peculiarly constructed",

even when I am willing to concede, that it is not „reglementary“ as is the common saying. As far as the subtile regulating is concerned I believe that the single methods of Kohl certainly need more regulating than former methods, and in this matter I have to say that the operator who is not able to understand another arrangement of telegraph as the simplest one, likewise is not fit to work the plainest apparatus, and hence there should be always telegraphoperators who are able to do somewhat more than merely to form Morsecharacters, to read them off, and write them down.

To the stated second difficulty of former methods that there should be a pretty fair insulation of the lines, I want to say, that, as in all telegraphic instruments so likewise in the counterspeaker, the best possible insulation of the lines always is desirable. The requirement of a proper isolation of the line

which has been mentioned by the Author as a defiency in former methods, now appear in the described methods to much as a capital requirement, that in this relation it not only stands be preferred to former methods, but undoubtedly set below it.

For the purpose of comparing it may be allowed to draw some of wellknown former methods in counterspeaking within the circuit of my observation. Previus however to entering upon this, I want allowed to make a paring remark,

To explain the counterspeaker, often it has been deemed necessary to set up the supposition, that it be possible to cause two currents of opposite direction to pass through one electric conductor. A certain Mr. Zantedeschi at any rate claims the honor of having proven the accuracy of this hypothesis as early as 1829, and has delivered two essays to the Academy of Sciences in Paris.

These hypotheris, which already have given rise to several erroneous notions are easily to be proven false through

Ohm's Law, but still better it would be in a different case

In this Journal annum 1855 page 202 Mr Dr W Gintl occupies himself in an extensive article communicated from the Meeting reports of the Imperial Academy of Sciences in Vienna with the question whether it be possible that opposite Currents pass simultaneously through the same wire without interrupting each other, and believes to answer this question affirmatively. As a proof of his opinion we find in page 207 fig 3 the communication of a current scheme and only apparently shown that in the upper wire, which runs from the writing style S to the writing style S', then should exist two currents in opposite direction, and indicates this by two opposite arrows. The existence of these two currents in the said wire is concluded from the phenomena which appear of the colored signals on the slip of paper, but when at the very moment that both keys are depressed, and both currents must

we
exist, remove suddenly entirely the respective wires
then nothing is changed in the phenomenon which shuld
prove the existing of both currents, and hence at the
same time the counterproof given that opposite currents
can not exist at the same time in an electric conduc
tor.

But now about some other methods of counter
speaking. First of all we meet in 1855 of
this journal, page 25., the Gintl's counterspeaker
the inventor of which has the same opinion
which we have declared entirely erroneous, that
two opposite current can exist simultaneously in
the same conductor. - We perceive from the sketch
itself, that the counterspeaker with a threefold
battery contact on the key of a peculiar equalization
battery &c has not met the desired results. In
how far now the application of the chemical
action of the electrical currents instead of the
electro magnetical action would have had a better

result is not exactly clear, as the chemical and magnetical actions of a current bear the same proportion to each other. Perhaps the greater practicability (serviceableness) of the electro-~~magnetical~~ chemical Counterpeaker, suggested by the inventor, is to be explained, that the coloring of the paper slip through the current did not exactly take place and cease, and hence the short interruptions through the motion of the key are imperceptible. The difficulty of keeping equalizations and line battery always in a certain proportion of the strength of current to each other, then the difficulty to make possible the momentary closing (three contacts on) of the key, further the interruption of the line when the key moves from the resting to the battery contact and inventor have to our knowledge failed to bring Gintl Counterpeaker in permanent use, although on page 135 of the same year the electro-chemical Counterpeaker is described in an improved way.

In 1856 page 121 we find the description of Prof Dr Edlund's Countinpeaken ~~xxxxxxx~~ proceedings, and is this the sole description, which has come to my knowledge, which should be so much the more decisive, as it originates from the inventor himself. Refering for the knowledge of Edlund's Countinpeaken to the aforementioned sketch itself, still I want to give a little denipten of it.

Edlund uses a plain key, one linebattery, and the current of the latter, when the key is depend, should divide and surround the own relay in two opposite directions, by which the same does not get affected.

Sketch fig 1 shows Edlund's course of current.

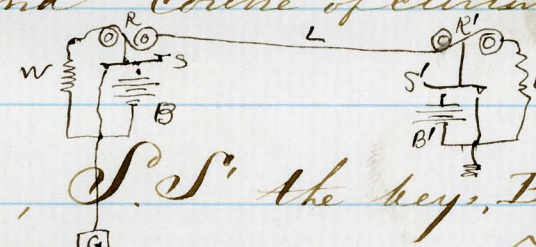

figure 1

Where R R' mean the relays, S S' the keys, BB' the linebatteries, and W W' resistances. If now for instance on Station 1 the key S is depend, then the current gets divided at A, surrounds

the relay of its own station, passes through the line, surrounds Relay R' of Station II, passes over a', and surrounds relay R' for the second time, and passes through the resistance W' to earth, by which relay R' becomes affected in the proposed manner.

The other partly current of battery B surrounds from a in opposite direction relay R, and passes through resistance W to earth.

If now the own relay, - here with regard to the above example, the relay B, over not become affected, then the opposite influences which the divided currents exercise on the relay should be alike, that is to say there must be either in both opposite routes, an equal quantity of the relay coil turns and hence for the remaining parts of the routes equal resistances; or the turns ought to stand in proportion to the respective resistances. If now we represent the resistance of the road from a over L to a' by l, the resistance of a over W to earth by

W, and in the same way for Station II the same by W', and we take it for granted, that the number of relay resistens in both branchlines be equal, then, when on Station I the key be depressed, we have

$$W = 1 + W'$$

So that no action on the relay takes place. If we want to get at the same aim on Station II then should be

$$W' = 1 + W.$$

If we compare there two formules, we see the impossibility to equalize the resistanes in the manner aforesaid, when W or W' be ever so small; furthermore each change of W should cause a change of W' and inversedly. Now, in order, to make disappear as much as possible in practice this above mentioned difficulty in the execution of the above formules, W and W' must be taken as small as possible, by which however in the same meanse also the proportion of the number of turns, which are law in opposite direction around

the relay must be changed. In order to make it possible to change the number of turns in the by line as needs be, the writer gives a description, — as Mr Kohl calls it, — of his peculiarly constructed relay, which cannot be granted entirely the plainness which is necessary so for practical purposes. Moreover we have the trouble here, that by inserting the plugs between S^{11} and S^{12}, and S^{12} and S^{13} (See Table VIII) there are closed wire turns around the electro magnet, and through its Suppressing ~~secondary~~ make slow the ~~action~~ working of the electromagnets. Likewise the dead turns could have been avoided, which originate, when plug m^2 does not stand in S^3.

Even the inventor admits, that already from the theoretical mere view we notice difficulties, and gives at the same time the means to do away with them practically. The circumstance, that when the battery on the own station is open the arriving current passes also through the coils of the by-line,

and hence increases the magnetism of the relay electro-
magnets in propatio becomes again completely annulled,
~~through~~ owing to the weakening of the current through
the simultaneously passing resistance apparatus.
When in this manner the passage of the arriving
current through the entire by-line neither does any
good nor harm, still the aggregate of resistance
of the entire route which the arriving current
passes, and the by-closings in the line come up
with more interruptions. I will afterwards deal
again with another difficulty, which arises from
the application of an uneven number of relay-coils,
and consequently little resistance in the by-line.

The method of repeating, which in conclusion the
writer suggests, of which it is said freely, that
it is not yet practically tested, seems to me
not recommendable, because the battery in the
state of rest of the apparatus is closed short
and aside from the considerable wear and tear of it

for each apparatus a separate battery is needed).

In 1860 book 11 and 12 of this Journal we yet find the description of a counterspeaking arrangement by Dr C. Schreder in Vienna, which may not claim any practical usefulness, but still may be considered as an interesting theoretical solution of the problem.

I now reach the counterspeaking methods which are suggested by Mess^rs Siemens & Halske in Berlin and myself. As there two methods which have been invented by us, ~~independently~~ independently from each other, are almost alike, we have combined our intents in this matter, and will I speak in the ~~following~~ future of these methods of counterspeaking as "our" methods. Although they are fully well known, we deem it proper to mention them here with a few words for Comparing's sake. One of our methods is shown in the next sketch (see fig 2).

R and R' are ordinary plain relays, the dividing of current at a a' takes place between two legs, so that one of the wirecoils lays in the mainline, the other in the by-line. As both legs have alike coils, hence the resistance in each by-line should be equal to that in the mainline. The departing current — Station I — branches off at a, and each part of current — surrounds a leg of the relay-magnet, but in such a manner that they form two alike magnetic poles which do not attract the armature. If at the same time there arrives any current from Station II, then, the line-batteries being alike directed, the current in the wire coil, which lays in the mainline will increase, pro contra, when the

fig 2

batteries have ~~a~~ opposite direction, decrease.
In both cases in one of the legs a superior magnetism is produced, and to the armature brought

to attraction. The disadvantages of this method are that as well in the moment of countersparking as likewise, when only the battery of a station is active, the receiving relay only works with one leg, although this difficulty may be lessened through relays which are alike, as far as the purpose is concerned. Furthermore, notwithstanding the magnet pole which forms on the relay of the same strength and name, there takes place still an unimportant influence on the armature, which increases together with the strength of the line battery used, and consequently there takes place always an injurious one, even when only an insignificant influence of the departing current on the own apparatus. When the arriving currents, for example on account of more powerful by-closings, but weak, then the same can only exercise little influence on the difference in strength of the magnetic pole, at the moment, that at the same time the forwarded

current surrounds the relay, as without it the departing current on account of the by-closing, and the so originating smaller resistance in the line, magnetizes more powerfully the own relay. Notwithstanding of these disadvantages this method of Countinspeaking is very fit for practical use, at any rate presupposes a better insulated line than the next method with double wapping of the relay.

By ~~Fig. 2~~ referring to next sketch I believe to have done enough to make this wellknown method comprehensible

Figure 3

The two wires laid around the relay-leg are rolled next to each other, and hence exercise a perfectly equal influence on the iron core, of course presupposing that the currents in both branchlines have the same strength, and consequently, as the number of wire coils in both branchlines is ~~are~~ the same —

the resistance in each of the by-closing must be equal to that of the main line. If we compare this scheme of current with that of Edlund, we observe a difference in as much as the vertingcontact of the key conducts to earth, and this circumstance makes it possible to comply with the conditions of the resistanceformules which we have left as unattainable in Edlund's method, and hence are entirely unlimited in the selection of the number of relay coils in the by-line &c. All difficulties which I have suggested in the various preceding methods of counterspeaking are not to be found in our last described method, and likewise the by-closings of the line have no more influence on the safe course of counterspeaking, ~~and the by-closings of the line~~ than on a single apparatus, under of course the same circumstances. In fact Edlund says in a note of his Essay, pag 130, after mentioning previously of being only slightly acquainted with my method:

" A very important difference is to be found
" in the fact that Mr. Frischen has the same number
" of coils in the by-line d.e.f, as in the line a b c
" (See fig 1) which was also the case in my
" investigation [1] of 1848. This however causes a
" great difficulty when telegraphing, as then the
" Vacillations in the resistance of the line to the nearest
" Station become too large, according the battery [open or] being
" closed on the other side. The result hereof is
" that the equalization becomes imperfect which
" causes insecurity in telegraphing."

In the same way Dr Schellen in his book
"the Electromagnetic Telegraph" 3d. edition page 316
Says:

"The reason thereof is to be found on the one
" side in the vascillating resistance of the line,
" according the battery on the other side being open
" or closed), in consequence whereof also a

[1] Investigation to measure Faraday's extra currents.

, Continuous regulating of the inserted artificial
" resistance becomes necessary, and ... "

Both parties however make a mistake, Mr Blunt probably having had his own scheme in view.; if a station sends forth current, then it is required that in both branchlines the currents, consequently also the resistances are equal; if now at the same time the remote Station depresses its key and sends current, then this changes of course the resistance and hence also the Strength of current in the main line; as however a change in the Strength of current in the main line altogether with its immutability in the by-lines is the main principle of the methods of countespeaking, and the change of Strength of current in the mainline can be caused just as good at the moment of Countespeaking (instead of through batteries), through a change of the resistance, hence the variety of resistance in open or closed batteries, mentioned by these

two gentlemen is not only a defficulty, but an advantage.

Dr. Stark in Sienna propsed in book 8 of this Journal. year 1855 a modification of our method, whereupon the number of the relay coils in the by-line and hence propotionally the resistance in them reduced, consequently a larger number of coils came to be placed, and so the sensitivity of the relay for the arriving current would increase. Figures here show, that when the proportion of the coils in the main and by-line is 12:1, then the Sensitivity of the relay for the arriving current increase to 1:1.67. In a postcript of the Editor it said that however then in the Stark" modification the linebattery ~~Hand~~ must produce a 5.87 times as powerful a current.

When calculating the larger amount of Sensitivity of the Relay with Stark's method the factor W (Resistance of the battery) comes in the balance as of some peculiar importance, and when for instance we take

the resistance in the mainline as 24 (German) miles (about 110 English miles) and hence, (leaves) the resistance of the battery $W = 1$, then we get the proportion of the sensitivity of the relay as 1 : 1.29, and even when we take the resistance of the line as 12 (German) miles, then the proportion would be 1 : 1,034, hence is not more favorable for Stark's relay, whilst here takes place a by far greater consuming of battery. Lines with extensive by-closings have very small resistance, and as through this the proportion of the resistance of the line to the battery becomes very unfavorable, — and in lines with by-closings more powerful batteries must be used, hence, seen from this point of view, Stark's relay modification can only be used with any advantage there, where the line resistance is large, and the battery resistance pro contra is very little. In the above calculation of proportion furthermore in Stark's method the increase of resistance ~~through~~ owing to the larger

number of coils in the line is not taken into consideration, as little as the so caused increased detrimental influence of the by-clarings. If now the increased consumption of battery also is taken in consideration, and the circumstance, that ordinarily we have to give up the idea of making use of a common linebattery for several apparatuses, then the advantage of Stark's relay modification disappears altogether, and for the purpose of obtaining a more powerful action of the relay with like coils in both lines an increasing of the linebattery would be more appropriate, especially as being not advisable, as I will show hereafter, to use considerably many coils of the relay in the main line.

That it better answers the purpose for obtaining a higher degree of sensitivity of the relay by making use of a more powerful linebattery, than the modification of our method suggested by Dr Stark, will be seen

from the next consideration.

In telegraphlines the Strength of current is almost proportional to the number of elements and, and when in our method we increase the number of elements in the line battery in the same proportion as the sensitivity of Stark's modified relay is larger, the superiority of the latter does not amount to much.

If we come back to the example quoted by Stark page 172, we find in his method the Strength of Current in the main line according to the formule

$$q \quad S' = \frac{E'}{113}$$

If now we suppose that the linebattery for example contists of 100 elements, then is $100\,e = E'$ and likewise the resistance of each solitary element, as $W = 1$, $w = 0.01$ and hence

$$S' = \frac{100\,e}{113}$$

If under the same circumstances with our method we use 167 elements, then is the Strength of current in the main line

$$s = \frac{167\,e}{1.67 + 100 + 1.67 \cdot \frac{100}{100}} = \frac{167\,e}{103.34}$$

Hence follows, as the coils in the main line stand in the proportion as 12 : 6,5, that the proportion of the electro-magnetic action is

$$\frac{167\,e}{103.34} \cdot 6.5 : \frac{100\,e}{113} \cdot 12 = 1 : 1.010,$$

Consequently there is no difference, and consequently with our method 167 elements were needed to compensate the advantage of Stark's modification when using 100 elements. If on the contrary we keep in view the wear and tear of the batteries, then we find in Stark's method the aggregate of current strength in the non divided circuit

$$S' = \frac{100\,e}{100 \cdot 8.33} = \frac{100\,e}{8.68}$$
$$100\,w + \frac{}{100 + 8.33}$$

and with our method.

$$S = \frac{167\,e}{167\,w + \frac{100 \cdot 100}{100 + 100}} = \frac{167\,e}{1.67 + 50} = \frac{167\,e}{51.67}$$

And so we get the relation

$$\frac{100}{8.68} : \frac{167}{51.67} = 11.5 : 3,2 = 3.59 : 1,$$

that is to say, with Stark's method there takes place, in spite of the smaller battery a 3.5 9 times larger wear and tear of the same, without any advantage being obtained through the greater number of relay coils.

We have already argued heretofore, that the method of Counterspeaking which we have suggested now recently is free of all the defects, to which all the other various methods are subject to; just as little with our method the by-clamps examine any influence, at least not to any higher degree as on a plain apparatus. Only from the influence of the rapid variableness in the size of the by-clamps of the lines our methods have to suffer in common with all others, and indeed this influence is greater as with the plain apparatus.

The variableness of the by-clamps alter the

resistance in the line, and therefore in both relay coils no complete equalization takes place any longer, and to come up with it the resistance in the by-closing must be altered correspondently. If the alteration of the by-closing takes place often and rapidly in succession, then this not only renders the handling of the counterpeaker more difficult, but its safety also becomes impaired, and it causes that counterpeakers on lines, whose by-closings for instance, through change in the temperature &c. change considerably, never can be used to advantage. However, as small differences cannot be avoided in any line, hence it may be recommended, to choose the relais with respect to the departing current not too sensitive, because then each little change of resistance in the main line causes a corresponding change of the departing current in each relay coil, hence the disturbing influence increases altogether with the number of coils, present in the main line

and it follows hence, that Stark's modifier relay also in this relation, is not recommendable.

The disturbing influence of the variableness of the by-closings (little ~~deeeee~~ vacillations within certain limits being left out of consideration) expresses itself in the activity of the counterspeaker in such a manner, that, when the motions of the relay are accurate, when acting singly, this is not any longer the case, as soon as the receiving station likewise sends off current at the same time, and hence there originates in counterspeaking easily "Confused writing". A regulating of the relay only can in a limited way remove the trouble, and only a steady corresponding change of the artificial resistance in the by-line can be of any effect. That such and needs not to a constant regulating of resistance cannot take place is evident, and would entirely not agree with the application of the counterspeaker, whence the counterspeaker frequently has shown itself to be "impractical."

this defect, the only one ~~under~~ of which our system is suffering may be overcome satisfactorily by making use of magnetized relays and double batteries. The next scheme will explain this:

figure 4

A battery is connected to each contact of the key which stand with opposite poles towards earth. When now the resistances are correspondingly equalized and the relay for instance of Station II, when there is no current present, be so inverted, that its magnetized armature or tongue with the hand motion remains laying as well on the battery contact as on the resting contact, then, when key S gets depressed on Station I, the current of battery K will press the relay armature of R' against the battery contact, whilst, when the key S lets go, the current of the K' battery will exercise an opposite influence on the magnetized armature, and press against the resting contact. Exactly the same process takes place

in regard to relay R and key S. It follows now evidently from a further examination, that no matter whether any changes of resistance take place in the line, this must remain without any influence on the safe working of the counterspeaker, as long as the inequality of the resistance does not become so great, that this causes the difference of the action of the departing current in the opposite coils of the relay to become greater, than the action through the arriving current. ~~Although this counte~~ Although this method of counterspeaking in the way described hereabove is perfectly fit for use, still the continual action of the batteries K and K' in the State of rest may be considered a difficulty. The latter may be removed by cutting out by means of a plain crank or plug cutter the battery K, respective K', and in its stead Connects the resting contact of the key with earth. This purpose is more properly

attained by means of Siemens & Halske's movable Sub-marine key, which spontaneously before the beginning and after the ~~finishing~~ ending of making use, inserts the battery resp cuts it out, and at the same time destroys the Connection with earth, resp establishes it. When repeating, Spontaneous (self acting) inserters and Switches may be used for the second battery, as this is well known. If we make use of a switch of the Second battery, then in the State of rest there is no current present and the armature of the relay consequently miss all directing power, and easily may drop against the battery contact and so cause the closing of the writing apparatus. In order to avoid this, the armatures of the relay should be pressed by a light Spring or through one-sided attraction of the magnetic armature against the resting contact, and the second batteries correspondingly reduced).

The object of this treatise being exclusively the examination of the various methods of counter speaking, it would ~~of~~ be much to the advantage of this matter, ~~to discover~~ when disadvantages of our method as well as of the methods of counter speaking finally described, and which might have been overlooked by ~~me~~ me, were discovered by somebody, which we earnestly request him to let me know.

January 17th 1863.