

DES MOINES AND ROCK RIVER RAPIDS, IN THE MISSIS-
SIPPI RIVER.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

The inspection report of Colonel S. H. Long, and the report of Lieutenant Warren of his operations during the past year on the Des Moines and Rock River rapids, in the Mississippi river.

May 22, 1854.—Referred to the Committee on Commerce, and ordered to be printed.

WAR DEPARTMENT,

Washington, May 20, 1854.

SIR: In compliance with the resolution of the House of Representatives of the 4th ultimo, "that the Secretary of War be requested to communicate to this House the inspection report of Colonel S. H. Long of December 20, 1853, and such other communications as may have been made by him in reference to the improvement of western rivers since the passage of the act of August 30, 1852; and also a copy of Lieut. Warren's report of his operations on the Des Moines and Rock River rapids, in the Mississippi river, together with any maps, charts, or diagrams of survey made by the last named officer during the past year," I have the honor to transmit you a report of the colonel of the corps of topographical engineers, with all the papers called for, except Lieut. Warren's maps, which he states it will require two months yet to make copies of.

Very respectfully, your obedient servant,

JEFFN. DAVIS,
Secretary of War.

Hon. LINN BOYD,
Speaker House of Representatives.

BUREAU OF TOPOGRAPHICAL ENGINEERS,
Washington, May 19, 1854.

SIR: I have the honor to submit the following report upon a resolution of the House of Representatives of April 4, 1854:

The resolution calls for—

1. The inspection report of Lieutenant Colonel Long of December 20, 1853.
2. Such other communications as may have been made by him in reference to the improvement of western rivers, since the passage of the act of August 30, 1852.

Being of the impression that all communications from this office coming within this inquiry were already in print, Lieut. Colonel Long was desired to point out the omitted letters, which he has done, and which are now copied, and are herewith submitted.

3. A copy of Lieutenant Warren's report of his operations (survey) on the Des Moines and Rock River rapids of the Mississippi.

4. Together with any maps, charts, or diagrams of survey made by the last named officer during the past year. These maps, charts, &c., were not received at this office before the 15th instant. They embrace twenty-three large sheets, and would probably require about two months of uninterrupted labor to make copies of them. Under these considerations, the present report, embracing items 1, 2, 3, is submitted in part.

Respectfully, sir, your obedient servant,

J. J. ABERT,

Col. Corps Topographical Engineers.

Hon. JEFFERSON DAVIS,

Secretary of War.

OFFICE WESTERN RIVER IMPROVEMENTS,
Louisville, December 20, 1853.

SIR: In obedience to instructions from the topographical bureau, I have the honor to submit the following report in reference to the western rivers, and the works in progress thereon for the improvement of their navigation, during the period of my late superintendency, viz: from the 1st of May last till the end of November, 1853.

The rivers to be treated of in this paper are the Ohio, the Mississippi, the Arkansas, the Missouri, and the Illinois.

The portions of these rivers claiming particular attention, by reason of their relations to commerce and existing navigation, and to the works required for the improvement of the latter, are the Ohio, from Pittsburg to its mouth, 1,000 miles; the Mississippi, from the mouth of St. Peters to Natchez, 1,785 miles; the Missouri, from the Council Bluffs to its mouth, 660 miles; the Arkansas, from Fort Gibson to its mouth, 590 miles; and the Illinois, from La Salle to its mouth, 245 miles; the aggregate distance on all of which, demanding improvements at this time, is 4,280 miles.

The improvements called for, consist in the removal of snags, sunken logs, wrecks, &c.; the construction of wing-dams and jettées, for reducing the width and increasing the depth of low-water channels; the opening of channels for low-water navigation across sand and gravel bars, by the process of dredging; the construction of canals and

sluices at rocky shoals and rapids; the formation and protection of commodious harbors at important commercial points, &c., &c.

With respect to the character of the rivers above mentioned, and of the improvements required therein, these subjects have been discussed so often, and reports thereon have so frequently been made, that they need not be specially reconsidered in this paper; yet a brief general view of their present condition, especially in so far as relates to the exigencies of existing commerce, is deemed appropriate on this occasion, and will be attempted, under distinct heads, as follows, viz:

OHIO RIVER.

From Pittsburg to Brown's island, about 66 miles, the river presents a series of rocky reefs and shoals, at which the low-water depth is too inconsiderable, in many places, to admit the passage of steamers of the lightest draught. Sluices have been opened at sundry points; and wing-dams, jettées, &c., of stone, resting upon rocky foundations, have been formed in numerous instances for the purpose of reducing the width of the channel, and compelling the water to flow in a narrower and deeper volume. Much benefit has resulted from the construction of works of this sort, but much remains to be done in this way towards the completion of the improvements of which this portion of the river is susceptible.

From Brown's island downward to Captina island, about 47 miles, rocky and gravelly bars alternate with each other, at intervals of much greater extent than in the river above, the principal obstructions to navigation being occasioned by sand or gravel bars, more or less blended with pebbles, boulders and rocks.

Several wing-dams have been partially constructed on this portion of the river, all of which ought to be completed, according to their original design, and some of them considerably extended; and in addition thereto, the construction of others, not yet commenced, would no doubt contribute much to the improvement of low-water navigation.

From Captina island to Letart's Falls, 128 miles, rocky reefs and shoals seldom occur in the main natural channel of the river, but bars of sand and gravel, on which the low-water depth is very inconsiderable, are of frequent occurrence.

At Marietta, Blennerhassett's island, and Buffington's island, side-walls and wing-dams of stone have been projected and partially constructed, for the purpose of diverting the water-flow from its natural course and directing it into the main low-water channels.

The dam at the head of Blennerhassett's island has in some measure produced the desired result, but the other works just mentioned have proved of doubtful efficacy. At these several points, and at many others on this part of the river, the process of dredging across sand and gravel bars may no doubt be applied to advantage.

At Letart's Falls, the obstruction is occasioned by a reef of rocks, extending quite across the bed of the river, through which the channel is narrow, and seriously obstructed by protruding rocks and boulders, over and between which the water is hurried with a velocity and to a fall of about five feet in a distance of less than half a mile.

From Letart's Falls downward even to Louisville, 375 miles, the bed of the river is pretty generally destitute of rocky bars, but in numerous instances the river spreads to a great width, and the navigation is much obstructed by bars of sand and gravel, in very low stages of the river.

The upper Ohio, commonly designated "the Ohio above the falls," presents comparatively but few snags and sunken logs, but its low-water navigation is much endangered by wrecks of steamers, flat-boats, and other craft.

The most dangerous obstructions of this character, including snags, logs, &c., have been removed from the low-water channel by the successful agency of the snag-boat Terror, (No. 5,) commanded by Capt. J. K. Dillingham, who has been employed during the last season, under the direction of C. A. Fuller, esq., on this portion of the river.

The special, frequent, and full reports that have been made in reference to the improvement of the falls of the Ohio, render superfluous any discussion of this topic on the present occasion.

From the falls downward to the mouth of the Ohio, about 400 miles, the navigation, in low water, is obstructed at numerous points by shoals, occasioned by sand and gravel bars, and in a single instance by reefs of rocks extending quite across the bed of the river. The most troublesome bars are the following, viz:

The Portland bar, a little below Sand island, and half a mile below the foot of the falls.

No considerable effort has been made for the improvement of this shoal, although it is believed that such an improvement might readily be made.

Formidable shoals again occur at Blue River island and Flint island, respectively 60 and 90 miles below Louisville, which are occasioned by indurated bars, which present serious impediments in the way of low-water navigation, especially the bar near the foot of French island; as yet, however, no attempts of any considerable moment have been made towards the improvement of either of these passes.

At French island, 78 miles, Scuffletown, 88 miles, and Three-mile island, 96 miles below Flint island, wing-dams of stone have been built for the purpose of restraining the low-water flow to narrow channels leading across the shoal bars at these several points; but the results obtained in each case are of doubtful efficacy. In these several instances the shoals have been occasioned by extensive bars of loose sand, stretching entirely across the bed of the river, which in every case is unusually broad. The dams having a mere bed of sand to rest upon, have been undermined and become dilapidated, and the water, in low stages, ceases to flow in the directions intended to be given by the dams.

Bars of similar consistency, but of less extent, are of frequent occurrence in the lower Ohio, and many of them are nearly or quite as formidable as those above mentioned. In view of the inadequacy of wing-dams, as a means of opening low-water channels across such bars, which has proved true in almost every instance of their introduction, I am inclined to repudiate their adoption in cases of the sort referred to. There are, no doubt, peculiar situations where their intro-

duction and use may prove beneficial; but I doubt not that the process of dredging, with apparatus properly constructed, and adapted to the removal of sand, gravel, &c., from the low-water channels across the bars, would prove more efficacious and economical, in general, and, at the same time, less objectionable on very many accounts, than the construction of wing-dams, jettées, &c., on sandy foundations.

In this connexion I take occasion to observe that the two dredge-boats constructed for use on the western rivers, though very well adapted to the improvement of harbors, and to the deepening and widening of channels across sand and mud bars, upon which the water has a depth of about three and a half feet; yet they are not applicable, and cannot be used to advantage, on bars having a less depth of water above them.

Instead of the boats above mentioned, which are too heavily loaded with dredge-ladders, buckets, and other heavy machinery, I would suggest a boat with dredging apparatus of a very different construction, and of the following general description:

1. A very light-draught twin-steamer, with scow-built hulls, each about 15 by 100 feet, and about 10 feet apart. The draught, when equipped for service, should not exceed 15, or, at most, 18 inches.

The steamers should be furnished with scrapers of a proper construction, applied between the hulls of the boat, and susceptible of being manoeuvred in a manner to scrape the sand, &c., from the bottom of the river, and convey it downward by the aid of the boat, and by that of the water-current.

2. The gearing and other apparatus for working the scrapers should be such that the latter may be appropriately set for receiving a charge of sand, &c., from the bottom; for being readily elevated when loaded, and brought into such a position that they may spontaneously discharge their load on arriving at the deep water below the bar.

3. Various items of tackle, including chains, windlasses, cables, warps, lines, &c., for manoeuvring the boat, scrapers, &c.; the whole to be worked by steam, except the manipulations requisite in shifting or changing the gearing and other attachments.

4. The boat should be furnished with quarters, kitchen, &c., adapted to the accommodation of the officers and crew required in the prosecution of the work of dredging.

N. B.—The project contemplates the removal of sand, gravel, &c., without raising the excavated materials above the surface of the water, and thereby provides for the saving of a power equivalent to $62\frac{1}{2}$ pounds for every cubic foot, or $1,687\frac{1}{2}$ pounds for every cubic yard removed, which would be lost by raising the excavated materials above the water's surface.

A plan and side-view of such a boat and dredging apparatus, together with sections of the sand, illustrating their various combinations, relative dimensions, and positions of their component parts, will be prepared and furnished on a requisition made therefor.

The Cumberland dam affords a remarkable example of the ability of a rip-rap structure composed of stones of irregular forms, sizes, and dimensions, and based on a mere bed of sand of great depth, to withstand a head and fall of more than four feet of water. However ques-

tionable the propriety of its ever having been constructed may be, yet the fact above stated has an important bearing upon numerous subjects connected intimately with the improvement of many of the western rivers.

This dam has been considerably enlarged and extended, under the direction of C. A. Fuller, esq., during the last summer, but is not yet completed. The operations upon it have, nevertheless, contributed to the formation of a navigable channel in low water between Cumberland island and the Kentucky shore, and to open an easy communication in a low stage of the river between the Ohio, at the head of the island, and Smithland, at the mouth of the Cumberland—a communication that could not previously be had either above or below the island.

The same operations have no doubt contributed to the formation of shoals at or a little below the foot of the island, (between four and five hundred yards below,) across which the low-water depth is about three feet only, when a depth of four feet may be found on the bars both above and below the dam.

The dredge-boat Gopher (No. 2) has been employed some time in efforts to open a channel across the shoals, but has failed of success, partly by reason of frequent interruptions from passing boats through the channel intended to be opened, and partly for the want of a sufficient depth of water at the shoals to admit the working of the dredge-boat. A dredge-boat of the character before suggested could no doubt be used to better advantage in opening the desired channel at this point.

Numerous bars on this part of the river, both above and below Cumberland island, require the operation of dredging, for the purpose of opening a low-water channel across them; and it is confidently believed that the means and manner of operation before proposed would prove more economical and efficacious than any others heretofore applied for similar purposes.

The rocky reefs called the Little and Grand Chains of the Ohio, respectively sixteen and thirty-four miles above its mouth, are rendered somewhat dangerous, by reason of numerous large boulders and other rocks situated in and near the low-water channel. Many of the rocks at the Grand Chain have been blasted and removed, while others remain at both Chains, opposing obstructions in the way of free and safe navigation in low stages of the river.

Snags, logs, and wrecks are occasionally to be met with on the lower Ohio, and have occasioned the destruction of several steamers. It is believed, however, that the most formidable of these obstructions will have been removed within the present month by the snag-boat Terror, (No. 5,) under the command of Capt. J. K. Dillingham, who has been employed on this part of the river for several weeks.

MISSISSIPPI RIVER.

That portion of the Mississippi (mighty river) in which the works of improvement have been in progress during the last summer and fall, extends from Dubuque, in the State of Iowa, to Natchez, in the State of Mississippi, and embraces a distance of 1,450 miles. In treating of

the works undertaken for the improvement of this river, I shall commence at the point first mentioned, viz: Dubuque.

The improvement of Dubuque harbor cannot be regarded as having any immediate connexion with the improvement of the navigation of the Mississippi, except in the light of opening an easy communication with a very thrifty and beautiful commercial town.

The method of improvement was devised by J. Barney, esq., United States agent, and sanctioned, I believe, by the Topographical Bureau, and partially carried into effect, under the direction of the same agent.

Of its merits, and the propriety of its adoption, I shall merely observe, that from a hasty inspection of the harbor, its islands, &c., without any authenticated plans or drawings, showing the former and present condition of the harbor, bars, and islands, by the last of which the harbor is secluded from the river, I am constrained to regard them as questionable, and of doubtful efficacy.

The work of improvement, after having been suspended several years for want of an appropriation by Congress, was resumed on the 1st of July last, under the direction of the same agent, and has been prosecuted with diligence during the residue of the last season. Much progress has been made towards the opening of a navigable channel from the main landing of Dubuque city, across bars, shoals, and low islands of recent formation, in the nearest direction to the easterly shore of the river. The new channel, however, is not yet rendered navigable for steamers except in very high water.

During the last season the work was carried on by the use of a dredge-boat (No. 1) constructed under the direction of Capt. Barney, at a cost of about \$20,000—the boat and four mud-scows being included. From the reports of Capt. Barney, it appears that the draught of the boat is too great (viz: about $3\frac{1}{2}$ feet) to operate successfully at that point in low water.

From Dubuque to the head of Rock Island rapids, 83 miles, there are very few obstructions to low-water navigation for boats drawing $3\frac{1}{2}$ to 4 feet.

The difficulties consist mainly in pursuing the very crooked and serpentine courses of the main low-water channel in its meanderings across the shoals.

The improvement of the Rock Island rapids has been committed to the charge of J. Barney, esq., the agent just before mentioned.

Surveys for determining the position of the channel most susceptible of improvement, and of the obstacles therein, in the way of navigation, were commenced early in July, under the charge of Lieutenant Warren, with the understanding that they would be executed in conformity to the joint counsel and aid of Maj. Floyd and Mr. Barney, and with the expectation that they would be completed early in October; but their progress was much retarded by high water, which prevented the accomplishment of the river work till a late date in November.

The surveys have been made with great care and precision, and the drawings constructed therefrom exhibit the features of the rapids in a clear light, and show, with distinctness, the positions, nature, and magnitudes of the obstructions to be removed.

Capt. Barney advertised for proposals preparatory to a commencement of the improvement of Rock Island rapids, early in October; but at the end of the usual period for receiving proposals, no acceptable offers had been made by contractors desirous of engaging in the work.

From Rock island to the Des Moines rapids, 130 miles, a few obstructions, consisting of snags, logs, and occasional boulders and other rocks, are here and there to be met with, but they cause no very serious or formidable impediments in the way of steamboat navigation, the low-water depth in the main channel, throughout this portion of the river, being $3\frac{1}{2}$ to 4 feet.

The Des Moines rapids have also been surveyed by Lieut. Warren, but the drawings, explanatory of the survey, have not yet been completed. Sketches from the copious field and river notes taken on the surveys of the Lower and English Chains have already been prepared, and from the results obtained, Major Floyd, the agent, has called for proposals, in due form, for the execution of the work on these two Chains; but by the latest intelligence from the agent, no favorable offers have as yet been made.

Sketches from the river notes taken on the other Chains, and relating to far the greater portions of the Des Moines rapids, remain to be drawn, and cannot properly be applied for this purpose without the personal attention and direction of the officer by whom they were taken.

Owing to the prevalence of water-stages unusually elevated during the month of July, the hydrographical surveys could not be commenced on either of the rapids till a late date in that month; and although they have been prosecuted with commendable skill and diligence on the part of Lieut. Warren, the field and river work in relation thereto could not be completed till the latter part of November; consequently, the work of improvement could not be undertaken till about the beginning of the winter season, when the weather becomes too inclement to admit of successful operations.

It is believed that the survey would have been accomplished at an earlier date but for the inability and failure of the agents, Messrs. Barney and Floyd, to aid and co-operate in their execution to the full extent contemplated and expected of them, in conformity to my instructions given in relation thereto, under date June 1, 1853.

From Des Moines rapids to the mouth of the Missouri, 192 miles, the river abounds with shoals, across which the low-water depth is but a little more than three feet, and the main channel across them is exceedingly devious and serpentine. Snags and logs that ought to be removed, some of them very dangerous, especially to navigation by night, are occasionally to be met with. A few days' labor with an efficient snag-boat and crew, in a proper stage of the river, would, no doubt, contribute to the removal of all dangerous obstructions of this character.

From the mouth of the Missouri downward to Natchez, 1,000 miles, snags, logs, wrecks, &c., are of frequent occurrence in the channels and on the bars of the Mississippi, and especially in the bends along the concave shores, the latter of which are exposed to abrasions by the force of the river-currents.

The low-water channel throughout the entire distance above mentioned has been successfully operated upon, and effectually cleared of

all obstructions that were presented at the time when the work was in progress. The removal of snags, &c., from the Mississippi, was commenced in the latter part of September, and has been prosecuted with all practicable diligence to the present date. Much remains to be done, however, on the bars in the *Island Chutes*, and even in the main channel itself; for it should be borne in mind, that although the channel depths are remarkably uniform in the lower stages of the river, yet on the subsidence of the latter, the bottoms of the channels subside at the same time, and new obstructions are continually presenting themselves at the bottom and sides of the channel thus deepened.

The removal of these, and of similar obstructions, from the sides of the channel, also the cutting of prostrate trees, &c., on the dry bars, the removal of snags, &c., from the chutes, the falling of impending trees, &c., &c.—

In order to exhibit a more intelligible view of the bends, &c., at which the operations of the snag-boats have been applied, I hereto subjoin a list of the more formidable and dangerous passes at which they have operated, beginning at the mouth of the Missouri, and ending at Natchez, premising that the low-water, or rather shoal channels, at all of the localities to be noticed in the list, have been effectually cleared of all obstructions visible and discoverable at the time of operation.

The list is as follows, viz:

Positions and distances from mouth of the Missouri downward to Natchez.

Designation of passes.	Character of passes.	Intermedi- ate dis- tances.	Total distances.
Sawyer's Bend.....	Snaggy and dangerous.....	10	10
Thence to Turkey Island.....	Snags, and scattering.....	60	70
Turkey Island Bend.....	Very dangerous.....		
Grand Tower.....	Very snaggy.....	15	85
Tower Island.....	Occasional snags.....	5	90
Cairo.....	Snaggy and dangerous.....	110	200
Bend at Island No 10.....	Dangerous.....	60	260
Island No. 18.....	Very dangerous.....	55	315
Island No. 21.....	Dangerous.....	5	320
Bend at Island No. 25.....	do.....	15	335
Islands Nos. 26 and 27.....	do.....	10	345
Head of Island No. 30.....	do.....	10	355
Bends at Plum Point and No. 33.....	Very dangerous.....	10	365
Bend at Island No. 34.....	Dangerous.....	10	375
Bend at Island No. 35.....	do.....	10	385
Bend at Island No. 37.....	Very dangerous.....	10	395
Devil's Elbow.....	Dangerous.....	10	405
Bend at Brandywine Bar.....	do.....	10	415
Paddy's Hen and Chickens.....	do.....	10	435
President's Island.....	do.....	10	445
Cow Island.....	do.....	10	455
Buck Island.....	do.....	20	475
Commerce Island.....	do.....	10	485
Council Bend.....	do.....	10	495
Grand Cut-off.....	do.....	10	505
Walnut Bend.....	do.....	10	515
Ship Island.....	do.....	5	520
Saint Francis Island.....	do.....	5	525

POSITIONS AND DISTANCES—Continued.

Designation of passes.	Character of passes.	Intermediate distances.	Total distances.
Helena Island, No. 60.....	Dangerous.....	10	535
Montezuma Bar.....	Very dangerous.....	5	540
Horseshoe Cut-off.....	do.....	10	550
Old Town Bend.....	Dangerous.....	10	560
Islands Nos. 62 and 63.....	do.....	5	565
Island No. 64.....	do.....	10	575
Island No. 65.....	do.....	5	580
Indian Charley's Bend.....	do.....	10	590
Islands Nos. 67 and 68.....	do.....	10	600
Island No. 69.....	do.....	10	610
Islands Nos. 70 and 71.....	do.....	10	620
Chicot Island Bend.....	Very dangerous.....	65	685
Kentucky Bend.....	do.....	30	715
Princeton Island, No. 87.....	Dangerous.....	10	725
Lava Island.....	do.....	15	740
Bunche's Cut-off.....	do.....	10	750
Island No. 93.....	do.....	5	755
Island No. 95.....	do.....	25	780
Islands Nos. 96 and 97.....	do.....	10	790
Island No. 98.....	Very dangerous.....	5	795
Island No. 100.....	Dangerous.....	10	805
Milliken's Bend.....	do.....	15	820
Pawpaw Island, No. 103.....	Very dangerous.....	10	830
Natchez.....	Occasional snags.....	170	1,000

In addition to the localities designated in the foregoing list, there are numerous other intervening bends and beaches in which snags and other obstructions to low-water navigation are more or less frequently to be met with; besides numerous impediments to high-water navigation, which abound in the shoals and upon dry bars, and more especially in the island 'chutes.

As before remarked, the low-water channels have been effectually cleared of all snags, logs, &c., discoverable during the late low-water season, while the shoals at the sides of the channels present numerous similar obstructions, not accessible to snag-boats in a low stage of water; and the dry bars are in many places overlaid and inlaid with prostrate and imbedded trees and logs, not less formidable in higher stages.

ARKANSAS RIVER.

The region drained by this river is apparently quite as spacious as that drained by the Ohio; while the extent of navigation afforded by the former and its tributaries, is less than one-fourth of that afforded by the latter and its tributaries.

The Arkansas river is navigable only to the junction of the three forks distinguished by the names of the Arkansas, Verdegris, and Neosho, viz: a little less than 600 miles from its mouth. Its channel throughout this portion of the river is, for the most part, narrow and very crooked; its current rapid—corresponding to an average declivity

of about eight inches per mile ; its bars occur at every bend, and are composed of sand and gravel, firmly compacted ; rocky reefs, extending quite across the channel, are of frequent occurrence on the upper half of the navigable portion ; while snags and logs of large size, and deeply imbedded in hard bars, are abundant, especially on the lower half.

The proper season for prosecuting the snag business on this river commences about the first of April, and terminates about the last of July. A rise occasionally takes place in October or November, but seldom continues long enough for successful operation with the snag-boats.

During the last season, the snag-boat No. 4 entered the Arkansas early in August, and succeeded in removing the snags from the low-water channel through a distance of about 60 miles upward from its mouth. In attempting to retreat from the river, this boat grounded on a bar a little below the White River cut-off, and was detained in consequence during an entire month, or 31 days.

It is proper to observe in this place, that the craft best adapted to the removal of snags, &c., from the Arkansas, is as follows, viz : a light-draught snag-boat, with single hull, accompanied by one or more machine-boats of the usual construction ; the latter being susceptible of towage from place to place by the former.

The channel of the river, especially in low water, is too narrow and crooked, and the current too rapid, to admit of the successful operation of a twin snag-boat of the usual size ; although in an elevated stage of the river, such a boat may operate to great advantage.

MISSOURI RIVER.

The obstructions in this river are quite as numerous and formidable as those in the Arkansas ; while the channels of the former are much broader, and the sand-bars much less compact, and of course the snags much less firmly imbedded, than those of the Arkansas.

Two of the snag-boats were employed in removing snags, &c., from an early date in August (about the 10th) till the latter part of September, (about the 20th,) when the river had subsided so much as to render a retreat to the Mississippi quite precarious. These boats succeeded in removing upwards of 500 dangerous snags from the low-water channel ; besides the cutting of trees and logs on the bars and shores, felling impending trees, &c. The portion of the river operated upon extends from its mouth to Smith's bar—about 160 miles ; beyond which they could not ascend for want of a sufficient depth of water in the deepest channel. The shoals at the sides of the channels operated upon were more or less frequently beset with snags, which were not accessible to the snag-boats by reason of the shoalness of the water. In more elevated stages, these obstructions become serious impediments in the way of navigation ; and their removal can only be effected by repeated efforts of the snag-boats, applied whenever the river is sufficiently full for the purpose.

The craft best adapted to the removal of snags, &c., in the Missouri, should consist of one or more twin snag-boats, of the largest class ; a

light-draught snag-boat, with a single hull; and one or more machine-boats, susceptible of being towed from place to place by either of the other boats. By means of such a flotilla, the more stubborn snags may be removed by the twin-boat, while the single-hull boat and the machine-boat can be employed to great advantage in removing obstructions from the shoaler parts of the river; moreover, the light-draught boat, in company with the machine-boat, can, without much inconvenience, continue their operations on any portion of the river between its mouth and the Council Bluffs, during the entire low-water season, or from about the middle of July to the middle of November.

In reference to the low-water channels of the Mississippi, Missouri, and Arkansas, and especially in reference to those of the two former rivers, it should be particularly observed, that they are seldom identical with, and do not occupy the position of, the deepest channels at more elevated stages; also, that the bars formed at the more elevated stages overrun, fill up, and obliterate the low-water channels; consequently, on the subsidence of the waters after every freshet, and especially after high floods, shoals begin to be presented, when the surface of the rivers have an elevation of some six, eight, or even ten feet above their extreme low-water marks. Hence, the removal of snags, &c., from the shoal channels, first formed after the subsidence of the rivers, affords no assurance that these channels will remain unobstructed during the entire progress of the subsidence to extreme low-water mark.

However protracted this period may be, the depth of the shoal channels remains nearly equable, while the surfaces of the rivers are constantly subsiding; and although these channels may have been effectually cleared of obstructions at the more elevated stages, the process of removing these obstructions must be repeated again and again some three or four times, in order to keep them unobstructed till the river falls to its lowest stage.

Accordingly, the phrase "*low-water channel*," as used under the three last heads, is intended to be applied in all stages of the rivers at which shoals exist; and the clause "*effectually cleared*" has reference only to that particular stage at which all obstructions had been removed from the main channels leading across the shoals existing at that stage.

Hence it is obvious that the removal of all obstructions from the low-water or shoal channels, and the opening of free and safe navigation through them at one stage of the river, do not insure safe navigation through them at a lower stage; also, that, in order to accomplish this object, the operations of the snag-boats must be repeated from time to time, not only in the same localities, but at intervening points, at every considerable subsidence of the river, from the time when channel obstructions are first presented till the rivers shall have fallen to their lowest stage.

In conclusion, under these heads it should be observed, that at the time of my late inspections the depths of the water in the main channel across the shoal bars of the Mississippi did not exceed the ordinary depths of the same channels in extreme low water, although the river surface at the same points was elevated 6 to 10 feet above extreme low-water mark.

ILLINOIS RIVER.

In ordinary stages of water, this river is remarkably favorable for navigation with steamers drawing four to five feet; and in the more elevated stages, for boats of much greater draught. In ordinary low water its navigation is much obstructed by numerous shoals; of which there are no less than thirty-three, respectively varying in their aggregate extent from 50 to 60 yards to a mile, and in one instance, at what is called the Naples flats, about 65 miles from the mouth of that river, to more than twice the distance last mentioned.

At the stages last alluded to, boats drawing more than two feet cannot pass these shoals without difficulty, and in a very low stage the depth of water on some of the bars does not exceed a foot in the deepest channel. The shoals are occasioned by bars composed of sand and gravel, somewhat indurated, most of which are covered with a fine adhesive mud.

The surveys instituted and commenced early in August last have been extended upward about 150 miles from the mouth of the river, and have resulted in the discovery that most, if not all, of the shoals, are pervaded by narrow and crooked channels three or four feet deep, too narrow and tortuous for steamers to pursue.

The dredge-boat Gopher was transferred from the Ohio to the Illinois in the latter part of November; and, after receiving sundry items of equipment and outfit, commenced operations in the latter river early in December. Her fitness for successful operations in this river is rendered somewhat doubtful by reason of her drawing too much water, and of the hardness of the bars to be operated upon. It is believed that a dredge-boat of the character before suggested in this paper would prove more efficacious and useful in the Illinois than any heretofore used for similar purposes.

The rivers upon which the snag-boats have operated during the past season, and prior to the 1st December, are the Ohio, the Mississippi, the Missouri, and the Arkansas; and the localities at which the dredge-boats have been employed are Cumberland island, in the Ohio, the lower portion of Illinois river, and the harbor of Dubuque.

The work done by the several snag-boats will be considered in the sequel.

STEAMBOAT DISASTERS,

caused by snags, &c., in the Mississippi river alone, within a period of one year, including the summer and fall of 1853, exclusive of wrecks that have occurred from similar causes in the Ohio, Missouri, and Arkansas, within the same period.

Under this head will be presented a synopsis, exhibiting the names of the steamers that have been wrecked, and the proximate localities at which they have been wrecked; which is as follows:

Synopsis of disasters on the Mississippi.

Ordin- nals.	Names of the steamers wrecked.	Proximate localities.
<i>Upper Mississippi.</i>		
No. 1	West Newton.....	Three miles below Lake Pepin.
2	Golden Era.....	Slein Island.
3	Shenandoah.....	Rock Island Rapids.
4	R. H. Lee.....	Rock Island Rapids.
5	Daniel Hillman.....	Des Moines Rapids.
6	Anne Livingston.....	Atlas Island.
7	Lamartine.....	Portage de Sioux.
<i>Middle Mississippi.</i>		
8	Georgetown.....	Tower Island.
9	Shelby.....	Selma.
10	Dunkirk.....	Bush Island.
11	Cincinnati.....	Willard's Landing.
12	St. Paul.....	Hat Island.
13	Australia.....	Hat Island.
14	General Jesup.....	Hat Island.
15	Robert Fulton.....	Shepard's Bend.
16	Oswego.....	Shepard's Bend.
17	Consignee.....	Shepard's Bend.
18	General Pike.....	Bainbridge.
19	Union.....	Bainbridge.
20	Pawnee.....	Hacker's Bend.
21	Saladin.....	Dog-tooth Bend.
<i>Lower Mississippi.</i>		
22	H. D. Bacon.....	Island No. 10.
23	Colonel Dickinson.....	Island No. 18.
24	Farmer.....	Island No. 18.
25	Midas.....	Island No. 16.
26	Connecticut.....	Cow Island, (No. 48.)
27	San Cloon.....	Island No. 82.
28	Western World.....	Princeton.

Of the steamers designated in the foregoing list, twenty-five were wrecked on snags, sunk logs, or old wrecks, and three only upon rocks.

On a fair average valuation of the damage done to the community by the loss of each steamer, if we include, first, the damage done to the boat and its machinery; second, the destruction and damage to freights of all kinds; third, the injuries sustained by the officers and crew of the boat by loss of employment; and, fourth, the damage done to passengers, by detention, interruption of business pursuits, or the sacrifices of time and money, comfort, and health, occasioned thereby, to say nothing of the loss of life, of valuable baggage and other effects, may, without exaggeration, be rated at \$50,000 for each steamer wrecked: accordingly, the loss sustained by the community within the short period of one year only, in consequence of the snagging of the twenty-five boats enumerated in the synopsis, will amount to the enormous sum of \$1,250,000.

If to this sum we add the amount of damages done by snags, &c.,

to loaded barges, flat-boats, rafts, &c., within the same period, and to their owners, which may reasonably be estimated at least one-fourth of a million of dollars, the aggregate annual loss of the community will be swollen to the appalling amount of \$1,500,000, or one and a half millions of dollars.

In view of what has actually been done in the way of removing obstructions from the Mississippi, and of what may again be done every year, it is fair and safe to assume that less than one-eighteenth part of the enormous amount just above stated, if annually appropriated by Congress and economically applied for the removal of snags, &c., from the Mississippi, would result in a saving to the community of three-fourths, certainly one-half, of that amount.

FLOTILLA OF SNAG-BOATS.

The flotilla, as before intimated, consists of four substantial twin snag-boats, with double engine and four boilers each—the boats respectively drawing, when fully equipped for service, about four feet each; and of one twin snag-boat with double engine, and two furnaces with one boiler each, this boat drawing about three feet when fully equipped.

The four boats first mentioned are adapted to operations in the Mississippi in all stages of the river, and in the Missouri and Arkansas in elevated stages only.

The smaller boat was designed for service in the Arkansas in the less elevated stages of that river, but is not so well adapted for use in that river, by reason of its slender construction and its unwieldy dimensions, as a light-draught snag-boat of the usual construction, with a single furnace and two boilers, would be.

The snag-boats are distinguished by the successive numbers 1, 2, 3, 4, and 5, the first four being of the heavier class, with two furnaces in each boat, and two boilers in each furnace; and the fifth of the lighter class, with two furnaces, and one boiler in each furnace. In all other respects the form and manner of their construction are common to all of the boats.

The manner of their construction is objectionable in several important details, of which the following are worthy of particular notice:

The furnace-frames are too high by at least fifteen inches, by reason of which the boilers, together with their safety-valves, steam-pipes, &c., are too much exposed to collisions from snags, in raising the latter between the hulls.

The fireplaces and chimneys should be situated at the aft ends of the boilers, instead of being at their forward ends. In the position last mentioned, the chimneys especially are liable to be injured in the raising of snags, and, without great caution on the part of the captain and mate, are likely to be thrown overboard, or otherwise prostrated, which is an accident of frequent occurrence.

The boats are all burdened with numerous heavy rollers stretching across their snag-ways, and serving to depress the boats and increase their draught materially, without any corresponding advantage. With the exception of the forward and aft rollers, (which are of cast iron) all others should be dispensed with, as also the deck floorings beneath

them, and an inclined platform, properly supported and fortified, should be substituted in their stead.

The snags, after being amputated, may as easily be slid downwards on the platform as upon the rollers; while at the same time the boat would be relieved of great weight, and be far less encumbered with a platform than with rollers.

In order to insure the transverse stiffness of the boat, a guy of round iron should be inserted within the caliber of the main windlass-shaft, and protrude far enough beyond the extremities of the latter to pass through and be firmly connected with the heads of samson-posts, rising from the boat, passing through the decks, and terminating a little above the axis of the shaft.

Stays connecting the heads of the posts with the main and guard gunwales of the boat should also be applied, as indispensable appendages in producing the desired transverse stiffness.

This method of producing transverse stiffness has been successfully applied by my directions to the snag-boat "Terror," (No. 5,) and effectually subserved the purpose for which it was intended.

Instead of a single boiler in each furnace of the boat last mentioned, I would moreover advise the substitution of two boilers of less diameter and of reduced length.

At the end of the present season for snagging, I would recommend that the alterations above suggested, and various others of minor importance, be made upon the snag-boats, all of which may be effected during the ordinary period of interruption by high water in the months of March and May.

The ordinary force in officers and crew required for working a snag-boat of the larger class, including some five or six hands employed in cutting prostrate trees upon the dry bars and shoals, in blasting stumps, and felling impending trees, may be stated as follows, viz:

1 captain,	1 carpenter,
1 first-mate,	1 clerk,
1 second-mate,	1 steward,
1 pilot,	1 cook,
1 assistant pilot,	1 cabin-boy,
1 first-engineer,	1 washerwoman,
1 second-engineer,	26 to 28 laborers;
1 striker and smith,	

in all, forty to forty-two individuals; all of whom, except the washerwoman and cabin-boy, should be able-bodied, active, willing, sober, and industrious men.

Snag-boat No. 5, which is of the smaller class, requires the same number of officers, together with a steward, cook, cabin-boy, and washerwoman, but a less number of laborers, and may be worked to advantage in the several respects above mentioned, with an aggregate force of thirty to thirty-two individuals, of whom eighteen to twenty should be laborers.

The force actually employed on board of the snag-boats, especially in the months of September and October, were reduced very far below those above mentioned, by sickness and desertion; and in the case of

one of the boats, No. 4, for a period of about three weeks, the operative force did not exceed six or eight laborers.

WORK DONE BY THE SEVERAL SNAG-BOATS.

The following synopsis will exhibit the nature, character, and amount of work done in the removal of obstructions from the Mississippi, Missouri, Arkansas, and Ohio rivers, during the months of August, September, October, and November, 1853.

In explanation of the tabular synopsis, it should be premised that the first column presents the numbers by which the several snag-boats are designated; the second indicates the rivers operated upon; the third, fourth, fifth, and sixth show the nature of the obstructions removed; the seventh exhibits the number of wrecks, consisting of steamers, barges, coal-boats, and other flat-boats, removed; and the eighth shows the number of steamers relieved by dragging them from bars on which they had grounded. The second column, moreover, contains literal references to notes of explanation subjoined to the table.

Synopsis of work done.

Designation of snag-boats.	Names of rivers improved by the removal of snags, &c.	Nature of obstructions removed.					
		No. of snags removed.	No. of stumps blasted.	No. of logs cut on bars and shoals.	No. of impeding trees felled.	No. of wrecks removed.	No. of steamers relieved.
No. 1 1	Missouri (a)	304	10	-----	30	-----	-----
	Mississippi	589	4	183	684	-----	-----
	Total.....	893	14	183	714	-----	-----
2	Mississippi (b)	478	-----	17	213	-----	1
3	Missouri (c).....	155	-----	14	274	-----	-----
	Mississippi	395	-----	16	65	-----	3
	Total.....	550	-----	30	339	-----	3
4 4	Arkansas (d).....	191	-----	271	108	-----	-----
	Mississippi	306	-----	38	31	-----	-----
	Total.....	497	-----	309	139	-----	-----
5	Ohio (e)	182	36	26	7	27	-----

Aggregate of the obstructions removed by all of the snag-boats—five in number.

1	-----	893	14	183	714	-----	-----
2	-----	478	-----	17	213	-----	1
3	-----	550	-----	30	339	-----	3
4	-----	497	-----	309	139	-----	-----
5	-----	182	36	26	7	27	-----
Grand total.....		2,600	50	565	1,411	27	4

Explanatory notes.

(a) No. 1 was detained about a week, by having both chimneys torn away, and on account of removals and repairs of the same, and of injuries to her boiler decks. Moreover, she was much incommoded by sickness on board in the months of August and September; also by discharges, and numerous desertions of laborers.

(b) No. 2 grounded on French Island bar, in the Ohio, on the 30th July, and was unavoidably detained thereon till the 13th September, (forty-three days,) during which she was carefully guarded, and received sundry items of work previously unfinished.

(c) No. 3 lost one laborer, who was drowned on the 10th August at the mouth of the Missouri. Detained twelve days on account of breaking fore-apron roller, of cast iron, three feet in diameter, for which a new roller must be substituted. Relieved steamer Atlas October 19th, steamer Illinois and barge October 24th, and Madison and lighter November 21st; all hard aground. Much hindrance by sickness and desertion of laborers.

(d) No. 4 grounded in Arkansas river, a little below White river cut-off, on the 22d of August, and was unavoidably detained till 22d September, one entire month, during which sickness prevailed on board to an alarming degree. Lost two laborers, viz: A. McAteer of New Albany, on the 16th, and James Zourd on the 20th September, who died on board. Force on board much reduced by discharges, sickness, and desertion; new recruits obtained, and the boats resumed work in the Mississippi on the 17th October.

(e) No. 5 commenced work in the upper Ohio about the first of May; was rendered inoperative at the head of the falls from July 22 to November 10, by reason of low water; and on the date last mentioned, she crossed the falls and resumed operations in the lower Ohio.

During the detention above mentioned, she received needful alterations and repairs, including two derricks at her bows, a set of cross hog-chains, with samson-posts, an enlargement of her cutting-beam, and fastening for cylinder timbers, re-caulking of boat-tops, &c.

These alterations were superseded by Captain Dillingham, who, in the mean time, occasionally served as assistant to C. A. Fuller, United States agent, on a reconnaissance of the river from Louisville to Pittsburg, and on a survey of the harbor of Marietta, and has been employed with his boat in removing snags, &c., since the date last mentioned, in the lower Ohio.

The obstructions removed by No. 5 are as represented in the table. The outlay per month, incident to her operations, is as follows, viz:

Fuel per month.....	\$285 09
Provisions per month	238 08
Services of officers and crew per month	980 43

Agreeably to a computation of C. A. Fuller, the average cost per day for the subsistence of each individual on board is 27½ cents.

N. B.—In regard to the several snag-boats of the larger class, the returns received from them are not sufficiently full and complete to justify any attempt at estimating the expenditures actually incurred per month on either of the accounts just mentioned, whether in relation to the cost of fuel, provisions, or services.

DISCIPLINE, POLICE, ECONOMY, &C., OBSERVED ON BOARD OF THE SNAG-BOATS.

The maintenance of good order and a well-regulated police, and an observance of scrupulous economy in the management of the boats, and all sumptuary transactions on board of the same, has been rigidly enjoined by the War Department, as set forth in the code of printed rules and regulations, copies of which have been furnished to the several captains of the boats, who are responsible for the proper administration of the same within their respective commands.

In addition to these rules and regulations, special instructions have been occasionally issued from headquarters of Western River Improvements to each captain, defining more particularly his duties and relations to the officers and crews of his boat, the management and disposition to be made of his boat, and the public property pertaining thereto; the purchase of fuel and other supplies required on account of the same; the manner of keeping accounts of all expenditures; of journalizing the

proceedings and operations of the boat; of rendering monthly and quarterly returns of work done; and all other transactions affecting the public interests, &c.

The instructions thus given have been exhibited in the appendix to my eleventh annual report, under date of September 1, 1853, to which I beg leave to refer. (See appendix, document marked K.)

No doubts are entertained that the captains of the snag-boats have used their best efforts to enforce a careful observance of the rules, regulations, and instructions above mentioned, on board the snag-boats placed under their command respectively; but with different degrees of success, according to the ability, tact, disposition, and experience of each captain. Industry, frugality, and a due observance of cleanliness, appear to have been prominent features in the management of all the boats.

The work done by each boat consisted in the removal of snags of the most formidable, and, in very many instances, of the most obstinate character.

The work done by the several boats, as already shown in this report, is respectable in a high degree, due allowance being made for the untoward circumstances attending its progress.

The compensation allowed, both to the officers and men, has been unusually high during the season, varying from 25 to 33½ per cent. on former allowances.

The allowance to pilots, in particular, has been nearly or quite doubled, in accordance with resolutions recently adopted by conventions of pilots held at St. Louis, and other western cities; but the advance in pilots' wages has not as yet affected the operations of the snag-boats except in one or two instances.

The advance in cost of fuel and other supplies of all kinds, required for the boats, has been quite as considerable as that for services; and the charges for repairs of accidents, removal of machinery, equipments, &c., have been quite equal to those for services.

The boats appear to have been managed with due care and caution, except in two instances, viz: in the destruction of both chimneys, and the injuries done to the boiler-decks of No. 1, and the fracture of the main cast-iron roller of No. 3, in both of which cases the injuries were probably unavoidable. The damages done in other respects are merely such as are attributable to ordinary wear, tear, and deteriorations.

There appears to be one particular feature in the administration of the affairs of the boats deserving special notice, which consists in the want of due subordination on the part of the crews of all the boats. This feature is obviously more or less observable and prominent according to the tact, temper, and judgment, evinced by the several captains. The subordination, &c., enjoined by the articles of enrolment, although guarantied by the signature of the operatives, is very little regarded by them, and cannot be enforced without due penalties prescribed and annexed to the infraction of their pledges.

I would accordingly suggest, as the safest and most efficient guarantee that can be adopted for the purpose of insuring proper discipline and subordination, of preventing desertions, and of promoting peace, harmony, and a cheerful co-operation on the part of all employed on

board of the snag-boats, that the penalty for desertion, and other flagrant derelictions of duty, consist in the forfeiture of all arrearages of pay that may be due to the delinquent at the time of his desertion, or other violations of the rules and regulations prescribed for the government of all employed on duties relating to the improvement of the western rivers.

The propriety of substituting rewards instead of penalties, for the purpose of promoting correct discipline, industry, and good behavior, especially among the laborers employed, although advocated by some, is, in my opinion, very questionable, and would probably tend to the subversion of order and good fellowship on board; for however worthless and inefficient any individual may prove to be, he is generally unwilling to admit that his services are not equally as valuable and praiseworthy as those of the most industrious and faithful of his coadjutors; while the awarding of a compensation to one, greater than that allowed to another, would be likely to engender dissatisfaction, animosities, and strife on board, and lead to results in all respects highly injurious to the service.

On assuming the control of the snag-boats, and transferring the same to the duly appointed captains, which took place on the 20th of July last, I found a very large supply of provisions on board, which had been procured by J. W. Russell, esq., and designed as a part of the outfit of the boats, consisting of pork, beef, flour, pilot-bread, and groceries of various kinds; also, of upwards of 17,500 pounds of bacon, hams, sides, and shoulders. Doubts having been entertained in regard to the quality of the bacon, I caused the same to be inspected by a duly qualified inspector of meats of this city. The inspection return of this officer exhibited, by summation, the following items, viz:

12,483 pounds bacon, including hams, sides, and shoulders, 1st rate.
2,690 pounds bacon, including hams, sides, and shoulders, 2d rate.
563 pounds bacon, including hams, sides, and shoulders, green, or 3d rate.
1,764 pounds sour and skippered.

Total, 17,500 pounds, being the aggregate of bacon on board.

The adequate meat ration to the subsistence of the officers and crews of the snag-boats may be fairly computed at one pound per day for each individual, the ration being composed of three distinct items, viz: $\frac{1}{2}$ pound of bacon; $\frac{1}{4}$ pound of salt beef or pork; and $\frac{1}{4}$ pound of fresh meat of various kinds. Hence, the allowance of bacon per month to each individual will be 15 pounds; for 2 months, 30 pounds; for 3 months, 45 pounds, &c., &c.

The meat ration, computed as above, may, perhaps, be regarded as an inadequate allowance; but when it is understood that large supplies of codfish, mackerel, &c., are usually furnished but not included in the meat rations, to which they properly belong, the contemplated allowance, without a doubt, is amply sufficient.

The average number of individuals for each boat is 40; and for the four snag-boats, 160: accordingly, the quantity of bacon required per month, for each boat, is 600 pounds, or, for the four snag-boats, 2,400 pounds. In accordance with this estimate, the quantity on board at the time of inspection, viz: 17,500 pounds, ought to be sufficient for the bacon part of the rations during a period of more than seven months.

The quantity of bacon procured as above, without any directions from me, and delivered on board of the boats by Captain Russell, as necessary to their outfit, was far greater than the exigencies of the case called for. 4,800 pounds, or a supply for a period of two months, should have been regarded as a full complement during any two of the summer months, when the safe-keeping and preservation of such an article is known to be very precarious. This extraordinary supply was put on board in the month of July, and has, no doubt, led not only to an extravagant use or prodigal waste, but to the destruction and loss of the article.

I would suggest that in all future supplies, not only of bacon, but of salt pork, beef, and all other articles of subsistence, the requisitions made therefor, and the purchases and issues thereof, be carefully scrutinized and limited to the amount actually required to answer fully all reasonable allowances for the comfortable and healthy subsistence both of the officers and crews during a specific period, of two months in hot weather, and three or four months in the fall and winter season. In the distribution of provisions of all kinds, purchased at the expense of the public, for the subsistence both of officers and laborers, all should share alike, as well in the quality as in the quantity distributed, no luxuries being allowed in any case, except at the expense of the individual requiring them; it being always understood that all necessary supplies of provisions should consist of sound, wholesome articles.

It appears to have been customary on board of the snag-boats for the officers to have their washing done gratuitously by the washerwoman serving on board, while the laborers have not been allowed to participate in this privilege. I would suggest the propriety of a change in this respect, viz: that the washerwoman be required to wash the bedding of all on board as an ordinary duty, and that she be allowed, for all extra washing that she might find leisure to do, a reasonable compensation per dozen or per piece, for articles washed, or washed and ironed, as well for the officers as for the crew.

The privilege of selling clothing, and other necessaries required on board, has been accorded to the captains of the boats, with the understanding that their charge for articles sold should in no case exceed 25 per cent. on the prime cost of the articles.

For sales thus made the captains have been allowed remuneration, with the consent of all parties, out of the pay due to the purchaser, at the time of the quarterly payments.

From a careful observance of the operations of the snag boats, it is very obvious that the captains thereof should possess a practical knowledge of the snag business; that they should be active, industrious, vigilant, and temperate; that they should be ordered with firmness and resolution, tempered with moderation and mildness; that they

should be competent to direct and supervise all proceedings had on board of the boats in relation to their police, as well as their operations; and, in fine, that they should be upright, honest, and energetic men, worthy of the respect and confidence of all on board.

The first mate should possess qualifications similar, in all respects, to those of the captain, in order that, in the event of sickness or absence of the latter, he may be competent to direct and control the operations of the boat, and all other proceedings in relation to the same.

The clerk should be an accurate and accomplished accountant and recorder, qualified by experience, skill, and judgment, to transact all fiscal and clerical concerns pertaining to the service in both of the capacities just mentioned.

All other officers of the boat should be well versed in the performance of the several duties of their appropriate stations. They should also be prompt and punctual in their attention to duties, and exemplary in their manners and deportment.

The laborers should be robust, healthy, strong, active, and industrious, and, in addition to these qualifications, should possess quiet and peaceable tempers, kind dispositions, and should be temperate and orderly in all respects.

Deviations from the precepts advanced as above, would undoubtedly tend to impair the efficiency of the forces employed; retard the progress of the work; and subvert economy in its prosecution. In order to obviate and prevent such results, and promote industry, harmony, and due subordination on board, restraints in the form of penalties, or forfeitures of some kind or other, should be inflicted in all cases of incompetency, disobedience of orders, and neglect of duties.

In administering the affairs of the snag-boats, and especially those relating to purchases and expenditures of all kinds, it seems to me prudent and proper that the captains and clerks should enter upon the discharge of their functions as such, under the guarantee of a solemn oath, taken in due form before a magistrate, by which they should be bound to discharge with fidelity, and to the best of their abilities, the several duties enjoined upon them respectively by the rules and regulations prescribed for their guidance and government. By such a guarantee, the temptations to collusions, peculations, and frauds, to say the least, would be far less forcible than they would be without such a sanction.

There are various other topics of minor importance that might with propriety be considered in this report, but the discussions herein have been carried to so great a length, that their introduction at this time may with propriety be dispensed with.

In conclusion, it is proper to add, that the aggregate balance derived from the several appropriations for the improvement of the western rivers, and still remaining in my possession, is six thousand seven hundred and eighty-nine dollars and six cents, (\$6,789 06;) also that this balance will be transferred to the credit of Lt. Col. J. E. Johnston,

superintendent of western river improvements, on his return from Washington, or as early thereafter as practicable.

Respectfully submitted:

S. H. LONG,

Lt. Col. Top. Engs., Late Supt. W. R. Improvements.

Col. J. J. ABERT,

Chief Top. Engineers, Washington, D. C.

P. S.—A copy of this report has been inserted in the third volume of the proceedings relating to the improvement of the western rivers, the whole of which will be transferred to the custody of Lt. Col. Johnston, on his return from Washington.

S. H. LONG.

No. 1.

OFFICE WESTERN RIVER IMPROVEMENTS,
Louisville, May 16, 1853.

SIR: I have the honor to report my arrival at this place on the 7th instant, and my assumption of the superintendency, &c., of western river improvements immediately thereafter, and in conformity to your instructions of the 27th ultimo.

On the receipt of the instructions mentioned, I addressed a circular, of which the accompanying paper is a copy, to Messrs. Russell, Barney, Fuller, and Daulton, United States agents for works pertaining to the improvement of the western rivers; but, as yet, have received no adequate returns, except from C. A. Fuller, esq., agent for the Cumberland dam and the Ohio river.

At the earliest practicable date after the reception of the returns in question, I propose to submit a report thereon to the Topographical Bureau. Lieut. Warren remains on duty with me, and is recognised as one of my assistants for the duties assigned by your late order.

The various duties enjoined by the instructions will receive due attention, with all the ability and promptness I can bestow.

In view of the performance of those duties in the most convenient and facile manner, all things considered, I would suggest the establishment of my headquarters at this city, which may be regarded as more central to the district of my superintendency, and more approximate to the seat of the general government, than any other commercial city that can be found on the western rivers.

I have the honor to be, sir, very respectfully, your obedient servant,

S. H. LONG,

Lt. Col. Top. Engs., Supt. W. R. Improvements.

Col. J. J. ABERT,

Chief Top. Engineers, Washington, D. C.

No. 2.

OFFICE WESTERN RIVER IMPROVEMENTS,
Louisville, May 30, 1853.

SIR: In view of my present relations to the public service, I deem it proper to signify my views with respect to the terms and conditions on which certain individuals heretofore appointed to the charge of works and operations relating to the improvement of western rivers should be continued in the public service.

The individuals alluded to, and the agencies assigned them, and the compensations authorized for their services, are as follows, viz:

John W. Russell, agent for the construction of snag-boats, and for the removal of snags from the Mississippi, Missouri, Ohio, and Arkansas rivers; salary \$2,500 per annum, together with an allowance for travelling expenses. It should be remembered that this agency, so far as it relates to the removal of snags from the Ohio river, has been transferred to the charge of Chas. A. Fuller, esq., by a subsequent order of Hon. C. M. Conrad, Secretary of War.

Joshua Barney, agent for the improvement of the harbor of Dubuque, Upper Rapids of the Mississippi, and for the construction of a dredge-boat; compensation \$5 per day, and 10 cents per mile for transportation.

Chas. A. Fuller, agent for the Ohio river, including Cumberland dam, and the construction of a dredge-boat; compensation \$6 per day, with the customary allowance for transportation when travelling under orders.

Chas. Daulton, agent for the improvement of the Illinois river; compensation \$150 per month, with the customary allowance for transportation when travelling under orders.

These several agents, except the agent for Illinois river, last mentioned, after having given the customary bonds of \$20,000 each, have been engaged in the public service for several months, and are expected to be continued in the service, on the terms, conditions, and agencies specified in their letters of appointment, subject, however, in all cases, to such modifications or changes, as the exigencies of the service may from time to time require, in the judgment of the undersigned.

With respect to the employment of Capt. Russell, after the construction, equipment, and outfit of the several snag-boats shall have been completed, I deem it advisable and proper that he be assigned to the general direction of the operations relating to the removal of snags and other obstructions from the channels of the Arkansas, Mississippi, and Missouri rivers, and that his personal attention be directed to these operations, in a manner to show where, and under what circumstances, and during what periods or portions of the year, the operations should be undertaken and kept in progress. The disbursement of the public funds committed to his charge; the payments for all services rendered on board of, or in connexion with the snag-boats; also the rendition of all returns of work done, payments made on account of the snag-business in these rivers, and the forwarding of the same to the headquarters of Western River Improvements, should, moreover, receive the careful and very particular personal attention of Capt. Russell.

As a substitute for his "travelling expenses," in removing from boat

to boat, &c., in the discharge of the duties above mentioned, I would suggest an allowance of five cents per mile for all distances actually and necessarily travelled by him in the performance of these duties.

With respect to the continued employment of Joshua Barney, it is proposed to retain the several agencies assigned him, as above mentioned, under his special care and direction, and to assign him such other duties as the exigencies of the service may from time to time require. His attention will be directed, in due time, to the survey and improvement of the Rock Island rapids of the Upper Mississippi.

With respect to the agency of Chas. A. Fuller, it will be continued unchanged, except in so far as relates to the performance of such incidental and extraneous duties as may be required of him, especially in relation to the fulfilment of other duties that have, or may hereafter be assigned him in the prosecution of former duties under my direction.

With regard to the agency of Chas. Daulton, it cannot yet be regarded either as undertaken or commenced, inasmuch as no bonds have yet been given, and no steps have been taken in the performance of the functions of his agency, so far as I have been informed on these topics. The subject of continuing Mr. Daulton in the agency for the improvement of the Illinois river, is respectfully referred to the decision of the Topographical Bureau and War Department. I would merely remark, in reference thereto, that the proper method of improvement obviously consists in the enlargement of channels across shoal-bars of frequent occurrence, by the use of one or both of the dredge-boats, and in the execution of surveys and soundings in advance of the dredging process, with the view of ascertaining the points, directions, &c., best adapted to the formation of the enlarged channels. These surveys can be made more conveniently and effectually while the dredging is in progress, and in the vicinity of these operations, than at any other time. As a compensation for an agent employed on work of this sort, I would suggest that \$5 per day, during the time actually devoted to the service, would be sufficiently liberal.

I take this opportunity to suggest, that in the appointment of any agents hereafter required for the prosecution of works relating to the improvement of western rivers, the compensation be limited, so as not to exceed \$5 per day for the time actually devoted to the duties of the agency.

Very respectfully, sir, your obedient servant,

S. H. LONG,

Lieut. Col. Top. Eng., Sup't W. R. Improvements.

Col. J. J. ABERT,

Chief Topographical Engineers, Washington.

No. 3.

OFFICE WESTERN RIVER IMPROVEMENTS,

Louisville, June 2, 1853.

SIR: Your communications of the 29th ultimo have been received, and will be complied with.

I avail myself of the privilege therein granted, and request that I

may be favored by the Topographical Bureau with a statement showing the condition of the appropriations and expenditures on account of western river improvements, *at the close of the first quarter of the current year*, from which date I regard myself as having been intrusted with the direction of western river improvements.

In my report of the 25th ultimo I have endeavored to include such a statement, and should be glad to test its accuracy, or otherwise, by a comparison with a statement of similar import from the Topographical Bureau.

Very respectfully, sir, your obedient servant,

S. H. LONG,

Lieut. Col. Top. Eng., Sup't W. R. Improvements.

Col. J. J. ABERT,

Chief Topographical Engineers, Washington.

No. 4.

OFFICE WESTERN RIVER IMPROVEMENTS,

Louisville, June 6, 1853.

SIR: I have received your letter of the 30th ultimo, in which the method of adjusting the accounts relating to western river improvements, as exhibited in my report of the 25th ultimo, seems virtually repudiated.

My approval of estimates thus far, with a single exception only, has been predicated on some practicable method of bringing estimates and expenditures under the respective appropriations out of which payments may be legally made. The method I have deemed most prudent and practicable under existing circumstances—indeed the only feasible method I can devise—is that set forth and explained in my report of the 25th ultimo, just before cited. Without the slightest disposition to be fastidious in any matters relating to the question of adjustment, I wish to be informed as to the basis of adjustment that may be substituted for that contained in the method proposed; for it is obvious, under the authority delegated to me by the rules and regulations prescribed for the government of all employed on works relating to western river improvements, that I can approve no estimates or expenditures without special reference, either expressed or implied, to the specific appropriations from which they ought to be liquidated. Hence, in the approval of all estimates, &c., I regard it not only as desirable, but as essential, that I should know the nature and amount of every appropriation from which funds are to be derived, the amounts that have been expended out of the same, and the balances remaining undrawn, in order that I may act according to law and regulation in all such cases.

By an inspection of the report, it may be seen that the expenditures and liabilities incurred in the preparation of snag-boats and dredge-boats for the improvement of the western rivers amounted to \$202,062 15 on the 10th of May ultimo, when nothing had actually been done towards the improvement of either of the rivers for which specific appropriations have been made.

The amount appropriated for the construction of snag-boats and dredge-boats for the improvement of western rivers by the law approved August 30, 1852, is \$150,000. This appropriation deducted from the amount of expenditures and liabilities as above, leaves a balance of \$52,062 15, which must be provided for out of other appropriations.

The question now arises, how shall the amount thus in deficit be distributed among other appropriations in accordance with the provisions of law? This question I have endeavored to solve in the report above cited, and in a manner, agreeably to the best of my judgment, most accordant with the facts of the case, and with the provisions of the laws, &c., affecting the same.

Your instructions in reference to this case, and especially in reference to the amounts chargeable against each of the specific appropriations specially considered in the report of the 25th ultimo, and more especially in reference to the items that may be charged against the appropriation for the construction of snag-boats and dredge-boats, (viz: \$150,000,) are respectfully solicited.

The sums required by the two requisitions *conditionally* approved by me (viz: \$23,000 by John W. Russell, esq., and \$3,000 by Charles A. Fuller, esq.,) are much wanted at this time, and I now beg leave to request that they may be transmitted at your earliest convenience, with or without the conditional approval, according as you may deem most advisable and proper.

Very respectfully, sir, your obedient servant,

S. H. LONG,

Lt. Col. Top. Eng., Supt. W. R. Improvements.

Col. J. J. ABERT,

Chief Top. Engineers, Washington, D. C.

OFFICE OF WESTERN RIVER IMPROVEMENTS,

Louisville, June 14, 1853.

SIR: In the discharge of your functions as United States agent for the improvement of the Mississippi, Missouri, and Arkansas rivers, you are desired and expected to conform to the rules and regulations prescribed by the honorable Secretary of War, a printed copy of which is herewith presented for your information and guidance, and to such other instructions as may from time to time be issued from this office in relation to your proceedings in all matters pertaining to the duties of your appointment.

On the completion of the works pertaining to the construction of snag-boats, your functions, station, &c., as a disbursing agent under the appropriation for that special purpose, will cease, and your agency will become general with respect to the rivers above mentioned, instead of local, as it has been while the construction of the boats was in progress.

Accordingly, instead of a local office for the transaction of your offi-

cial business, you are expected to hold all your proceedings, both financial and supervisory, on board of the snag-boats, dividing your attention between them severally, as circumstances may render expedient, except on or after the close of each quarter of the year, and the liquidation of accounts payable thereafter, when you are expected to repair to headquarters of Western River Improvements, at Louisville, and make due and full returns of your official proceedings, and of all operations performed by the boats under your direction during the previous quarter. A room has been provided for your official accommodation at said headquarters whenever occasion for its occupancy by you may be presented.

The ordinary duties required of you are of the following import:

1. A general supervision of all operations performed by the snag-boats on the rivers included within your special agency.
2. The order in which the rivers shall be operated upon, and the force, both of men and boats, with which the operations are to be effected, due regard being had to high and low-water stages, and to healthfulness or otherwise of the seasons for operation.
3. The points or localities at which the removal of snags, logs, &c., the felling of impending trees, the blasting of stumps, &c., are most needed in order to obviate the dangers and promote the safety of navigation.
4. The procuring and forwarding to the boats all periodical supplies of provisions, and all other necessaries for the comfortable and healthful subsistence of the officers and crews of the boats.
5. The selection of points or positions at which injuries to either of the boats may most readily and economically be repaired. Also, the selection of harbors at which the boats may be laid by on any other occasion.
6. A general supervision and inspection of the boats, and all articles of public property pertaining thereto, and the adoption of measures conducive to their preservation, protection, and safe-keeping.
7. Investigations and inquiries in relation to the method of administering the affairs of each boat, and to the police regulations observed and maintained on board thereof, and especially in regard to the maintenance of industry, sobriety, good-fellowship, and total abstinence from profanity, vulgarity, ineptitude, intoxication, and all other improprieties, inconsistent with the rules of the service.
8. A careful supervision of the manner in which the superintendent's clerk performs the various duties assigned him, agreeably to item 4th of the preliminary regulations, with a view not only to the accuracy of the minutes, accounts, journal, &c., kept by him, but to the uniformity or similarity of the method of transacting such business on the part of all serving as clerks on board of the several snag-boats.
9. In the performance of the duties above considered, you are expected to avail yourself of the counsel, advice and concurrence of the captains of the several snag-boats, individually or collectively, as may be found most convenient.
10. The special duties to which your attention is directed are exhibited briefly in the following list:
11. The preparation of a summary statement, showing the cost of

each snag-boat constructed under your direction, including hulls, engines, and all fixtures and attachments connected therewith.

12. The preparation of an inventory, showing in detail all articles of equipment, and the cost thereof, respectively, for each snag-boat; it being understood that all detached or movable articles, such as anchors, cables, purchase-chains, blocks, coils of rigging, and other tackle, smith's tools, saws, axes, augers, &c., &c., &c., are to be regarded as articles of equipment.

13. The preparation of a similar inventory, showing in detail all articles of outfit, and their cost respectively for each snag-boat; it being understood that cooking-stoves, kitchen-furniture of all kinds, tables, chairs, table-linen, towels, provisions of all kinds, lamps, lanterns, and oil for all purposes, assorted medicines, and medical instructions, per lot, &c., &c., are to be included.

14. Official returns under these several heads—viz: first, a summary return of the cost of each snag-boat; second, an inventory containing the designation and cost of each item of equipment; third, an inventory, setting forth the designation and cost of each item of outfit—are expected to be prepared and rendered prior to the commencement of river operations with the aid of the snag-boats. These returns to be prepared and rendered for each boat, viz: three returns for each boat.

N. B.—The return for snag-boat No. 5, so far as relates to its construction and equipment, is expected from your hand; but in so far as relates to its outfit, the return is expected of C. A. Fuller, esq.

15. Monthly statements or estimates, on or about the first of every month, showing as nearly as practicable the amount expended during the preceding month, the amount required for the current month, and the unexpended balance on hand at the date first mentioned, viz: the first of the month; together with a requisition for the amount required for the current month. A statement of this character is desired monthly from each boat, and in its preparation you will avail yourself of the aid of the superintendent's and boat's clerk.

N. B.—From these returns, when received at this office, an abstract will be prepared, under the direction of the superintendent, in which a suitable distribution will be made with reference to the specific appropriations from which the sums required may be drawn.

16. In conformity to the instructions of the Hon. Secretary of War, (see item 7th of the preliminary regulations,) payments for services, &c., are to be made quarterly, by pay-rolls, vouchers, &c., as usual, (see paragraph 17th, and its subdivisions 1 to 12, regulations corps topographical engineers,) in the preparation of which you will be aided, as before, by the superintendent's clerk.

N. B.—All the accounts, &c., contemplated in this as well as the preceding items of these instructions, will be addressed to the superintendent of western river improvements, and forwarded by mail to this office for examination and approval, to be disposed of according to circumstances.

17. "The quarterly returns of instruments, tools, machines, and other public property," required by regulations, (see printed regulations, paragraph 14, p. 12,) will be made to and through this office; and all

articles worn out, damaged, lost, or otherwise injured or destroyed, will be noted in a separate column of the return provided for that purpose, and headed "remarks."

18. Blank forms for enrolment, time-rolls, pay-rolls, vouchers, abstracts and accounts-current, certificates, log-books, monthly returns of work done, diet returns, &c., &c., will be furnished from this office, on your requisition therefor, and will be appropriately filled and duly forwarded to this office, under your special direction, and as nearly as practicable and expedient in accordance with models prepared.

19. The articles of enrolment having been duly signed by the officers and others constituting the crew of each boat, and the same having been duly verified by the captain of the boat, and approved by yourself as United States agent, a copy of the same will be transmitted to this office as soon thereafter as practicable.

20. In all your fiscal transactions, you will be held accountable, through this office and the Topographical Bureau at Washington, to the United States Treasury Department, as heretofore, and are expected to conform to the instructions heretofore given you in relation to such transactions.

21. The performance of the duties explained as above will require frequent journeys from river to river, and from boat to boat; also various other journeys proper to be made, for the purpose of determining the localities at which the operations of the boats are most needed. All such journeys as you may deem expedient and proper for these purposes will be performed by you, and the travelling expenses incurred thereon will be allowed on vouchers duly executed.

22. In your capacity of United States agent for the improvement of the Mississippi, Missouri, and Arkansas rivers, you are also regarded as an agent and assistant to the superintendent of western river improvements, and are accordingly authorized to exercise a general supervision and control over all snag-boats operating on said rivers, the special command of each boat in the prosecution of the snag business, and of the officers and crew attached to the same, being reserved and confided to the captain of the boat, who is entitled to the exercise of all the privileges and authority vested in him, agreeably to items 5th and 6th of the preliminary regulations.

23. Additional instructions will be issued, from time to time, from this office, as occasions may require, in answer to suggestions or inquiries coming from you, or from other sources.

24. All official communications from yourself, or others employed in the service, are expected to be forwarded by mail to this office.

Very respectfully, sir, your obedient servant,

S. H. LONG,

Lieut. Col. Top. Eng., Sup't W. R. Improvements.

J. W. RUSSELL, Esq.,

U. S. Agent for Improvement of Mississippi,

Missouri, and Arkansas rivers, Louisville, Ky.

No. 5.

OFFICE WESTERN RIVER IMPROVEMENTS,
Louisville, June 17, 1853.

SIR: Your instructions relating to the improvement of the harbor, &c., at Marietta, Ohio, and the memorials and other papers accompanying the same, have been received.

The objects contemplated therein have, unquestionably, a high claim to consideration, in connexion with other matters relating to the improvement of the western rivers; but, in my opinion, as also in that of the United States agent for the Ohio river, they are of a local rather than a general bearing, and should be provided for by a special appropriation "for the improvement of the harbor of Marietta."

With the view of determining the nature, extent, and probable cost of the works required at that place, I would propose that suitable surveys, soundings, and delineations be made by the United States agent, for the purpose of obtaining the requisite information on these several points, as early as practicable, (consistently with other duties required of him;) the results of which will be forwarded in due time, and form the basis of an estimate for the improvement in question, to be submitted to Congress for their action at the next session.

The views of the agent, Charles A. Fuller, esq., in relation to the improvement under consideration, are exhibited in the accompanying report of that officer.

Very respectfully, sir, your obedient servant,

S. H. LONG,

Lieut. Col. Top. Eng., Sup't W. R. Improvements.

Col. J. J. ABERT,

Chief Top. Engineers, Washington, D. C.

OFFICE OHIO RIVER IMPROVEMENTS,
Louisville, June 17, 1853.

SIR: My attention having been called to a memorial of the citizens of Marietta, Ohio, in reference to the improvement of the Ohio river at that locality, I would respectfully take leave to make a few remarks thereon, with a view of giving whatever information I may possess in reference to this matter.

The surveys at and near Marietta were made by myself, (under the direction of Captain John Sanders, U. S. engineers,) in the summer of 1838, and at a stage of water unprecedentedly low.

The Ohio river is divided, by Marietta island, into two channels, of about four miles each in length. The Virginia channel has been considered the most favorable for low-water navigation; having, at the date of the survey in question, not less than eighteen inches water, while the greatest depth in the Ohio channel, opposite Marietta, was nine inches; thus cutting off the town of Marietta at low water, and rendering it obligatory on the wharf-master to remove his wharf-boat to the foot of the island, and contiguous to the Virginia channel.

In order to render Marietta accessible during the lowest water, Captain Sanders recommended the construction of a dam, about 2,000 feet in length, at the head of the island, and across the Virginia chute, together with a jettee at the foot of the island, of about the same length. By throwing all the water at a six-feet stage and under down the Ohio channel, and confining it at the foot by means of the jettee, and, in connexion therewith, dredging the bar at the mouth of Duck creek, one and a half mile above, and removing the logs and snags which constantly accumulate thereat, it was supposed the navigation might be kept up at this locality during the low-water season. Owing to the limited appropriations, however, no dam was built at the head, and but a small amount expended at the foot.

I have always considered this method of improvement as decidedly local in its character; having for its principal object the improvement of the harbor of Marietta. Were the interests of the town of Marietta not considered, the plan undoubtedly would be the construction of a dam across the *Ohio* channel, at the head of the island, together with slight dredging across the narrow gravel-bar in the Virginia chute, and on which there was found, at the lowest stage, eighteen inches water. This channel, thus opened, would be shorter and wider; and the logs, snags, &c., thrown out by Duck creek would be avoided.

In conclusion, I would state, that there are no funds at my disposal applicable to the improvement of the harbor of Marietta, without express authority to apply them to that object.

Respectfully, sir, your obedient servant,

CHARLES A. FULLER,

U. S. Agent and Engineer O. R. Improvements.

Lieut. Col. S. H. LONG,

Superintendent W. R. Improvements, Louisville, Ky.

No. 6.

OFFICE WESTERN RIVER IMPROVEMENTS,

Louisville, June 20, 1853.

SIR: I have received your letter of the 14th instant, with other communications of the same date, viz: one in answer to requisitions of John W. Russell, esq., as approved by me, and another in answer to requisitions of Charles A. Fuller, esq., otherwise approved.

In the letter you state that "if he (C. A. Fuller) has received a boat which has been partially paid for out of the appropriation under Capt. Russell, he should refund to Captain Russell the amount paid by the latter, then the boat will stand in his accounts as procured exclusively out of the appropriation for the benefit of which it is to be used."

I feel constrained to question the legality of the construction thus given, inasmuch as it seems to be in conflict with express enactments of Congress in reference to appropriations, and take leave to offer a few brief remarks showing the reasons of my objections to the construction.

The appropriation for the construction and repair of snag-boats, dredge-boats, discharging-scows, machinery, (machine-boats?) to be

used on the Mississippi, Ohio, Missouri, Arkansas, and other western rivers, was \$150,000.

The boats constructed consist of five twin snag-boats, viz: four drawing about four feet each, and one drawing two and a half feet; two dredge-boats and eight scows, with yawls, &c. No machine-boats have been constructed.

The twin snag-boat drawing two and a half feet was designed specially for the Arkansas river, and is better adapted for service in that river than anywhere else, being too light and inefficient for successful operation in either of the other rivers.

This boat has been transferred to Charles A. Fuller, esq., for service in the Ohio river, for which it is not sufficiently powerful and capacious. By this transfer the snag flotilla is left destitute of any craft properly adapted to work in the shoal, narrow, and tortuous channels of the Arkansas.

The cost of the snag-boats, dredge-boats, &c., above mentioned, inclusive of outlays and liabilities, on the 10th of May ultimo, as per schedules submitted in my report of the 25th of the same month, was \$202,062 15, which has exceeded the appropriation for the construction and repairs of snag-boats, &c., by \$52,062 15.

The mode of distributing this excess among the appropriations from which the whole has been drawn, has been set forth, and, as I believe, clearly explained in my report of the 25th May, above cited, and is, in my opinion, the only way in which it can legitimately be accounted for.

The appropriation for construction, &c., (viz: \$150,000,) was, in my opinion, designed to cover all costs for purposes of construction, as well for the *Ohio river* as for the Mississippi, Missouri, and Arkansas rivers. In my report of the 25th May, I regarded it in this light, and accordingly assessed all expenditures that had been then incurred under their appropriate heads of appropriation, viz: under the heads of construction and repairs, (the repairs being those required by the old engines of the Hercules, Samson, and Sevier,) of equipments, (including all fixtures and attachments of the boats,) and of the outfit, (including tackle, tools, provisions, &c.,) for the several snag-boats, dredge-boats, and scows.

The arrangements and distributions under these heads, as exhibited under the same in the schedules accompanying my report of the 25th May, are deemed the most equitable and appropriate that can be made under existing circumstances, and under the provisions of law affecting the case.

In this connexion I take leave to signify the opinion I have entertained, and still entertain, as to the number and character of the boats required under existing appropriations for western river improvements, which is as follows, viz:

- 2 large twin-hull snag-boats, similar to the Hercules;
- 2 light-draught single-hull snag-boats, similar to the Dragon;
- 2 machine-boats, similar to those heretofore in use;
- 2 dredge-boats, such as are now ready, or nearly so, for service;
- 8 mud-scows, similar to those now being constructed.

These several boats might have been constructed, to a certainty, at the following prices, viz:

2 twin snag-boats, at \$30,000 each	\$60,000
2 light-draught single-hull snag-boats, at \$14,000 each ..	28,000
2 machine-boats, at \$1,500 each	3,000
2 dredge-boats, at \$18,000 each	36,000
8 mud-scows, at \$600 each	4,800
Unexpended balance, reserved for repairs, &c.	18,200
Amount of appropriation	<u>150,000</u>

The small twin snag-boat now in charge of C. A. Fuller, esq., is not well adapted to the operations required in the Ohio river, but is far more applicable to those required in the Arkansas, and at remote points up the Missouri river.

The width and heavy draught of the other snag-boats render them unfit for successful operations in the Arkansas, especially in low stages of the river.

The craft best adapted to the removal of snags, &c., for the Arkansas, would, in my opinion, consist of one or more light-draught snag-boats, with single hulls, and one or more machine-boats that could be towed from place to place by the light-draught snag-boats.

The foregoing is a compend of the reasons of my objections to the liquidation of any payments for the construction of boats out of appropriations specifically made for the improvement of the rivers in question.

It is believed that the reasons and explanations exhibited in this and other papers heretofore submitted in reference to the same subject, will convince the honorable Secretary of War, yourself, and the accounting officers of the Treasury Department, that the mode of adjusting the accounts relating to western river improvements, recommended in this and former communications, and especially in my report of the 25th May last, is the best that can be adopted in the case now before us.

Respectfully submitted:

S. H. LONG,

Lieut. Col. Top. Engs., Supt. W. R. Improvements.

Col. J. J. ABERT,

Chief Top. Engs., Washington, D. C.

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No. 7.

OFFICE WESTERN RIVER IMPROVEMENTS,
Louisville, July 15, 1853.

SIR: On my arrival this morning, after a tour of official reconnoissance and inspection, via the Ohio, Mississippi, and Illinois rivers, the upper rapids of the Mississippi, Dubuque, mouth of the Illinois, Lasalle, and Chicago, I had the honor to receive, at this office, sundry communications from the Topographical Bureau, and other official sources.

Among the communications received, your instructions of the 27th

ultimo seem to claim an earlier attention than any other yet perused, and I accordingly take leave to submit the following brief reply:

Certain exceptions have been taken by the honorable Secretary of War to my views as set forth in my report of May 30, 1853, which are of the following import, viz: that the appointment of John W. Russell, esq., as United States agent for the construction of snag-boats, and for the removal of snags from the Mississippi, Missouri, and Arkansas rivers, is to be regarded as having been superseded on my assignment to the superintendency of western river improvements, except in so far as relates to the construction of snag-boats commenced and nearly completed under the agency of that gentleman, which may be continued until the preparation of said boats for service shall have been completed, should the undersigned deem such continuance desirable.

In reference to this condition, I take leave to remark, that all measures affecting the details of construction having been adopted and carried into effect under the sole agency of John W. Russell, esq., I deem it expedient, as well as desirable, that he be retained in his agency of construction, &c., till all liabilities and expenditures incurred on that account, as also on account of equipments and outfit, under his direction, be settled and finally cancelled; in order to the accomplishment of which, the period of his agency must necessarily be extended to some future date, probably not exceeding four to six weeks hence.

In regard to the agency for removing snags from the rivers above mentioned, that of Captain Russell being dispensed with, I take leave to suggest that some individual of ability and integrity, well versed in river business, skilful as an accountant, and reliable as a disbursing officer, be appointed to the agency vacated as above, should such an appointment meet the approbation of the War Department and Topographical Bureau.

Your instructions of the same date apprise me also of the revocation of the appointment of Charles Daulton, esq., and of the recommendation of a suitable disbursing agent to fill the vacancy thus occasioned.

The testimonials in favor of Geo. A. Dunlap, esq., are strong in his favor, and, to the best of my knowledge, deservedly so. On my late tour, I acquired some knowledge of his character and qualifications as a financier and man of business, but have never been apprized of his skill and experience as an engineer. With the aid of an experienced hydrographer and manager of river operations, I have no doubt of his ability to perform the duties of agent for the improvement of the Illinois river to advantage.

Mr. Daulton, in his capacity as agent, and preliminary to entering upon the active duties of his agency, had made arrangements to employ Maj. Geo. W. Long, of Alton, Illinois, formerly of the United States army, to aid him in the field operations, river work, &c., pertaining to the same. Similar arrangements may no doubt be made with the same individual for his co-operation with Mr. Dunlap. Major L. has forwarded credentials signed by gentlemen of high standing, and commanding him to the agency in question, but, in the event of his failing in the application which he has made to the honorable Secretary, would no doubt be gratified with the appointment of engineer in charge of the

field-work under the agency of Mr. Dunlap, with a compensation not exceeding \$5 per day, during the time actually employed.

I take occasion to observe that the Illinois river is now at a proper stage to commence the surveys, defining its hydrographic limits and depths, and indicating the shoals at which improvements are needful. An early commencement of the surveys is desirable, in order to have the shoals suitably marked prior to the dredging of the channels, which may probably be commenced about the middle of September next, or as early thereafter as one or both of the dredge-boats now in the service of western river improvements can be spared for that purpose.

Very respectfully, sir, your obedient servant,

S. H. LONG,

Lt. Col. Top. Engs., Supt. W. R. Improvements.

Col. J. J. ABERT,

Chief Top. Engs., Washington, D. C.

No. 8.

OFFICE WESTERN RIVER IMPROVEMENTS,

Louisville, July 18, 1853.

SIR: I have the honor to report, briefly and compendiously, the results of my observations and inquiries made on a late tour of examinations and inspections in the discharge of my official duties, and in accordance with your instructions of the 27th April last—the journeys having been performed between the 21st of June last and the 15th of the current month.

The tour of examination, &c., embraced the Ohio, below the falls; the Mississippi, from the mouth of the Ohio upwards to Dubuque; the Illinois, from its mouth to the head of its natural navigation; and the country thence by way of Chicago, Upper Sandusky, and Cincinnati, together with the Ohio river between Cincinnati and Louisville.

At the date of my departure, (June 22,) the snag-boats, in charge of Captain Russell, were nearly ready for service, lying in port near the city, but could not be conveyed down the river, by reason of the low stage of the water then prevailing in the Ohio.

The depths on the more difficult bars between Louisville and the mouth of the Ohio, varied from three to three and a half feet; whereas the draught of the snag-boats, when in trim for service, is about four feet.

The navigation of the Ohio below the falls is not only obstructed in low water by numerous sand-bars, but by many snags and sunken logs, which render the navigation in a low stage quite hazardous. The dry bars were, moreover, infested with logs and prostrate trees, all of which require removal, and were intended to be operated upon as soon as the snag-boats could be got ready for service.

The Mississippi was at a medial stage, too high for observing the snags, &c., in the way of low-water navigation. That portion of this river situated between Cairo and the mouth of the Missouri is reputed to abound in snags, &c., which can only be discovered and operated

upon in a stage of water much lower than that existing at the time of my late examination.

The upper Mississippi, at the same time, was swollen to a depth of six to nine feet above extreme low water. Impediments to its navigation, in the shape of snags, sunken logs, &c., are seldom to be met with. Its low-water channels afford a depth sufficient to admit of boats drawing nearly three feet to pass freely in the principal channels, except at the rocky bars that exist at the Des Moines and Rock Island rapids, at both of which, and especially at the former, the channels are exceedingly crooked, and in places very narrow and winding. The low-water depths on the shoalest reefs do not exceed eighteen inches, and the width of the channels does not exceed forty to fifty feet. The stage of the river at the time of observation was too elevated to admit of any measurements by which the width and depth of the low-water channels could be determined.

Agreeably to instructions previously given, I found Lieutenant G. K. Warren, with the concurrence of J. Barney, esq., and Major Floyd, engaged in the survey of the Rock Island rapids, or rather in preliminary surveys on shore, for the purpose of establishing stations to which triangulations for determining the widths of the river at various points, and for designating the positions of the channels where improvements are required.

The sand-bars of the upper Mississippi, traversed by low-water channels, admit the passage of boats drawing three feet in ordinary low stages of the river. Hence it may be inferred that the depth of the channels through the rapids, in corresponding stages, need not exceed three and a half or four feet, which last will be the depth to which the channels will be opened, unless otherwise ordered—the width, as before contemplated, being two hundred feet.

The rocks constituting the bed of the river at both rapids, being, for the most part, a loose, slaty, or schistose limestone, unfavorable for blasting, will prove more difficult of reduction and removal than hitherto supposed, especially as the work of blasting must, in all cases, be effected beneath the surface of the water.

At the harbor of Dubuque the process of dredging was resumed, under the direction of J. Barney, esq., on the first day of July instant. Disappointments, unavoidable in the preparation of the requisite mud-scows, rendered an earlier commencement impracticable.

With respect to the method of improvement adopted by J. Barney, esq., with the view of connecting the harbor with the main navigable channel of the river, the reasons have not been fully explained to me; but as it has no doubt received the approbation of the Topographical Bureau, no question of its propriety will here be raised.

The work of dredging will no doubt occupy the entire period from the 1st July to the 1st, possibly to the 15th, September next, after which the dredge-boat is expected to be employed on the improvement of the Illinois river.

The Illinois river has an extent of natural navigation of two hundred and forty-four miles from its mouth to La Salle, and had its navigation obstructed in low water, by shoals or bars of greater or less extent, at no less than thirty-three points. The low-water depth at the several

bars varies from twelve to thirty inches, while the channels or basins between the bars are said to afford a constant depth of three feet in the lowest stage. The aggregate distance through which the channel requires widening and deeping, does not probably exceed eight or nine miles. A channel three feet deep and two hundred feet wide, to be opened across the several bars, is deemed the best improvement of which the river is susceptible.

I have employed George W. Long, esq., formerly of the United States army, to perform a reconnoissance of the river, at a compensation of \$5 per day, and travelling allowance, for the time actually employed, and to report thereon as early as practicable.

On the receipt of his report I shall probably be able to take measures for the speedy commencement of preliminary surveys and demarcations of a character to show the curvatures and area of the low-water surface of the river, and designate the positions at which improvements will be required.

The Ohio river between Cincinnati and Louisville has been operated upon by the small snag-boat No. 5, (the Terror,) during the months of May and June, and to the present time. Numerous impediments to its safe navigation, consisting of wrecks, snags, sunken logs, impending trees, &c., have been removed, and the facility of its navigation greatly improved.

I regret to inform you that the continued low stage of the Ohio has rendered it impracticable for the snag flotilla to descend to the mouth of the river, and commence operations in the removal of obstructions from the Mississippi, Missouri, and Arkansas rivers.

Very respectfully, sir, your obedient servant,

S. H. LONG,

Licut. Col. Top. Engs., Supt. W. R. Improvements.

Col. J. J. ABERT,

Chief Topographical Engineers, Washington.

No. 9.

OFFICE WESTERN RIVER IMPROVEMENTS,

Louisville, August 1, 1853.

SIR: I have the honor to report, that on Friday, the 29th ultimo, the snag-boats Nos. 1, 2, 3, and 4, took their departure for the Mississippi, under orders to operate as follows, viz: Nos. 1 and 3 on the Missouri, and Nos. 2 and 4 on the Arkansas river.

The late rise of the Ohio was deemed by the captains of the boats, and by all others consulted, sufficient for the passage of the boats across all the shoals of the Ohio below the falls.

The water on the falls was not sufficiently high to admit of the passage of snag-boat No. 5, (the Terror.) In consequence, this boat is unavoidably detained above the falls till a more considerable freshet shall occur. Availing myself of this detention, the boat at the same time being prevented by low water from operating on the Ohio above, I propose to make such alterations in the construction of the boat as

are deemed advisable, in order to fit her for service on the Arkansas and Missouri rivers.

Very respectfully, sir, your obedient servant,

S. H. LONG,

Lt. Col. Top. Engs., Supt. W. R. Improvements.

Col. J. J. ABERT,

Chief Topographical Engineers, Washington.

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No. 10.

OFFICE WESTERN RIVER IMPROVEMENTS,

Louisville, August 1, 1853.

SIR: On Saturday, the 30th ultimo, I embraced the earliest opportunity presented for an examination of the light-draught twin snag-boat No. 5, (the Terror,) constructed under the direction of Captain John W. Russell, and now for service on the Ohio, but originally designed for operations on the Arkansas river.

I find the boat deficient in the following respects: Her capacity for generating steam is barely adequate to a continuous speed of about five miles per hour through the water; her butting beam is too slender for safety and efficiency in loosening snags, planters, &c., by butting; her outside knuckles dip too deep in the water, and require strong transom stays of iron to raise them; her fastenings for the engines are too weak and unsubstantial; her rollers are too heavy, and are not deemed necessary to the operation of the boat: they should be removed, and an inclined platform should be substituted. Various other alterations of less moment are desirable, in order to render the boat properly serviceable either on the Arkansas or Missouri rivers. I have previously reported this boat as not properly adapted to service in the Ohio river.

The boat being detained at this time above the falls, and rendered inoperative by reason of the low stage of the river, I deem it advisable, under such circumstances, and with the view of remedying the deficiencies as far as practicable, to commence the contemplated alterations without delay, and, if possible, to have the boat in a proper condition for service on the occurrence of a rise in the river sufficient to carry the boat across the falls. Captain Dillingham, the captain of the boat, can be employed to advantage in superintending the alterations.

Very respectfully, sir, your obedient servant,

S. H. LONG,

Lt. Col. Top. Engs., Supt. W. R. Improvements.

Col. J. J. ABERT,

Chief Topographical Engineers, Washington.

No. 11.

OFFICE WESTERN RIVER IMPROVEMENTS,
Louisville, September 3, 1853.

SIR: I have the honor to enclose herewith the accounts of J. W. Russell, esq., United States agent, for the second quarter of 1853, which on examination appear to be generally correct and in due form, with the following considerable exceptions, viz:

In voucher No. 4 of my official accounts, under the head of western river improvements, for the second quarter of 1853, a compensation at the rate of \$1,200 per year from the 10th of May to the 30th of June, amounting to \$170, has been introduced as an allowance to Mr. Tilford for his services as clerk, which is in accordance with my agreement with him.

In voucher No. 11 of Captain Russell's accounts, herewith, under the head of improvement of the Mississippi in the same quarter, (second quarter of 1853) a compensation at the rate of \$1,000 per year, viz: \$250, has been introduced in favor of Mr. Tilford for his services as clerk to J. W. Russell, for the whole of the same quarter (second quarter of 1853.)

The latter compensation seems to be claimed by Mr. Tilford on the score of his having performed the services last mentioned *out of office hours*.

Deeming this charge in part if not wholly inadmissible, I take leave to submit the question to the decision of the Topographical Bureau, while at the same time I am ready to admit that the services of Mr. Tilford have been in a high degree arduous.

The objects of expenditure in other respects seem legitimate and proper; and as they relate for the most part to matters over which I could have no control, I submit the accounts with but a single additional comment.

Captain Russell's personal charges for services during the entire quarter are approved by me, by reason that his services as agent were not only regarded as desirable, but altogether indispensable in the settlement of accounts relating to all works and operations committed to his charge, especially in so far as they related to outstanding claims on account of the construction, equipment, and outfit of the snag-boats. It is obvious that such claims could not properly be settled by me, inasmuch as I could not be expected to have an adequate knowledge of the details upon which they were based.

Accordingly, I deemed it prudent and proper to retain Captain Russell in the capacity of agent to the end of the quarter.

Respectfully, sir, your obedient servant,

S. H. LONG,

Lt. Col. Top. Engs., Supt. W. R. Improvements.

Col. J. J. ABERT,

Chief Topographical Engineers, Washington.

LOUISVILLE, October 9, 1853.

DEAR SIR: 1. As some difficulty has arisen about the final settlement of my accounts with Colonel Long, I beg leave to trouble you with a brief statement. The amount in controversy is not much, but as I am ambitious to stand well in your estimation, I trust that you will pardon me for now troubling you. You informed me last spring that Colonel Long had been appointed superintendent of western river improvements, and that thereafter I was to make my reports through him. I was continued by Colonel Long in the discharge of the same general duties, and without any change of salary; when, about the 15th of July last, I was informed by him that the Secretary of War was under the impression that I was superseded as U. S. agent, by his appointment as superintendent; and that unless my services were *absolutely necessary*, they would be dispensed with. Colonel Long remarked that he deeply regretted that he should lose my services, but that in the then condition of the business, they *were absolutely necessary*, and that I must go on and attend to the business as theretofore.

2. About the 31st of July, Colonel Long made out a requisition of articles which he deemed necessary to complete the outfit and equipment of the boats, and directed me to purchase and have them on board of each boat within four days. These purchases and the outstanding liabilities, including salaries of officers and wages of hands, amounted to a sum in the aggregate over \$18,000. I made the purchases according to his orders, creating accounts, many of them for small sums, and scattered over New Albany, Portland, and Louisville. Some of these accounts embraced four or five pages; all of them, of course, had to be divided *pro rata* and made out in duplicate for each river.

3. On the 29th of July the boats departed, and I was then informed by Colonel Long that I should make out all the accounts and present them to him by the first of September, as he had his report to make up at that time. He stated that if I did not receive the money on my requisition of the 23d of June, he had himself made a requisition, and would furnish me with means to liquidate all claims against the government.

4. Colonel Long then informed me that he intended making me his assistant superintendent, and proceeded to define the services which he would expect me to perform, viz: to pay the officers and crew of each snag-boat every quarter; to furnish provisions, and money to purchase fuel, and to direct the general movements of the boats; and that he would allow me a clerk at fifty dollars per month, and desired me to look out for some suitable person for that office. I still continued to discharge all the duties of the office of agent, but when I should commence to act as his assistant superintendent my pay should be five dollars per day.

5. Early in the month of August the Northern Bank of Kentucky made an offer to Thomas D. Tilford, (who was the clerk of Colonel Long, and mine also,) of a clerkship in the bank, with a salary of several hundred dollars more than he was then getting, and with the promise of an increase on the first of January next, an offer which Mr. Tilford felt it incumbent on him to accept. As soon as Mr. Tilford in-

formed Colonel Long of this, he seemed to regret it most deeply, and expostulated against it in the most vehement manner. I regretted deeply myself the loss of Mr. Tilford, who was a most admirable clerk, and the more so as I am impressed with the belief that Colonel Long entertains the suspicion that I had something to do in obtaining this appointment for Mr. Tilford. I had nothing to do with it; at all events, from this time Colonel Long's whole conduct towards me was changed. He then, for the first time, told me that I could not be continued in any capacity in the employment of the government, and intimated that it was by the direction of the Secretary of War, or in accordance with his wishes. I asked him to discharge me in writing, and say that it was by the direction of the Secretary. This he refused to do, and I continued in the service as heretofore, by his express direction.

6. On the 7th of September one set of accounts was handed over to Colonel Long; and, for the first time, he refused to allow me clerk-hire, although he had agreed, when Mr. Tilford became his clerk, that he should receive pay as my clerk also, provided he worked eight hours per day in his office; and you will see by my accounts of the 30th June, that Tilford received pay for both offices. Colonel Long then also for the first time refused my office rent, after having positively directed me to keep my office where it was, and there to close up the business.

7. I think that I am entitled to what I *actually* paid for clerk hire, and which Colonel Long knows I paid, and what I *actually* paid for office rent, and to my regular salary of \$2,500, until my connexion with the government ceased. I was finally discharged by the Secretary of War, by letter of the 13th September, which I received on the 19th of the same month.

8. I have felt it due to myself to make this statement, and am entirely willing that you shall settle the whole matter. There is a balance in my hands of \$297 56, and the government is indebted to me for the balance of my salary, office rent, and clerk hire, all of which has been made out and presented to Colonel Long, and is now in his office.

I have the honor to be, very respectfully, your obedient servant,
JOHN W. RUSSELL.

Col. J. J. ABERT.

No. 12.

OFFICE WESTERN RIVER IMPROVEMENTS,
Louisville, December 1, 1853.

SIR: A detailed reply to your instructions of the 15th October last, and to the communication of Captain Russell of the 9th of the same month, therewith enclosed, has been unavoidably postponed to the present day, for want of sufficient leisure to examine the records of this office, in quest of documentary testimony relating to the same.

The communication above mentioned was evidently prepared by Thos. D. Tilford, formerly a clerk of this office, and subsequently the reputed clerk of Captain Russell, and embraces a motley combination

of fabulous and anachronistic statements, of a character to give erroneous impressions with respect to the true state of affairs therein discussed.

For the purpose of exhibiting the circumstances therein treated of in their true light, I have divided the letter into a series of distinct paragraphs, numbered from 1 to 8, and shall endeavor to furnish a reply to each, in the following order, viz:

Paragraph No. 1.

The difficulty in the settlement of Captain Russell's accounts, consists in the withholding of certain allowances to which he thinks himself and his clerk entitled; the allowances being of the following import, viz:

1. Allowance to Captain Russell for office rent from July 1 to August 31, 1853, 2 months, at \$10.....	\$20 00
2. Allowance to Thos. D. Tilford, for extra clerk hire, from May 10 to June 30, $1\frac{2}{3}$ month, at \$83 33 $\frac{1}{3}$	141 65
Allowance to Thos. D. Tilford, for extra clerk hire, from July 4 to August 15, $1\frac{1}{2}$ month, at \$83 33 $\frac{1}{3}$	125 00
3. Allowance of salary to J. W. Russell, as agent, from July 27 to September 3, 1853, $1\frac{8}{9}$ month, at \$208 33 $\frac{1}{3}$	263 88
Amounting to	<hr/> 550 53 <hr/>

N. B.—In relation to item 3d, as above, it should be observed, that according to notice previously given, (viz: on the 20th of July,) I was willing to allow Captain Russell \$5 per day for his services as my assistant, in settling accounts contracted under his direction, from July 27 to September 3, inclusive, viz: 39 days, at \$5 per day, amounting to \$195.

But as Captain Russell manifested a desire to receive full pay as agent, viz: \$208 33 $\frac{1}{3}$ per month, together with allowances for clerk-hire and office rent, I declined payment till otherwise instructed by the War Department.

Accordingly, the difference between the allowance I was disposed to make, and that claimed by Captain Russell, is as follows, viz:

Amount claimed by Captain Russell, as above	\$550 53
Amount proposed to be allowed by me	195 00

Difference	<hr/> 355 53 <hr/>
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The proposed allowance excluded any charge for extra clerk hire, and for office rent from and after the end of the second quarter of 1853.

My reports of the 28th and 29th of September last, submitted to the bureau in company with, and in relation to the accounts of J. W. Russell for the second and third quarters of 1853, are in accordance with the statements made as above.

In regard to allowances for office rent and clerical services, Captain Russell was distinctly informed, by written instructions dated on the 8th and 14th of June, which were never revoked, that a suitable office was provided for his accommodation at headquarters Western River

Improvements, and that the office then and previously occupied by him must be surrendered.

Captain Russell was distinctly informed, on or about the 20th July, at a meeting of the captains of the snag-boats, at which he was invited to be present, and was present, that a change in the administration of affairs relating to the prosecution of the snag business had been required by the War Department, and that the snag-boats would, on that date, be transferred to the command of said captains; also that his services as agent would be dispensed with as soon as the equipment and outfit of the boats could be completed. Moreover, he was at the same time informed, that on and after the completion of the outfit of the snag-boats, which took place on the 26th of the same month, his services were "desirable" and indispensable in the preparation and settlement of the accounts and liabilities incurred under his direction. In the performance of the duties last mentioned, he was distinctly informed that he must serve in the capacity of assistant to the superintendent, and not as United States agent.

The arrangements thus made were regarded by me as in strict accordance with the instructions of the War Department, which were received on the 15th of the same July through the Topographical Bureau, and which had been forwarded in reply to a report rendered by me, in reference to the employment of agents previously appointed and employed on duties relating to western river improvements.

The following is a copy (extract) of the instructions mentioned, which were dated on the 27th June, and received on the 15th July following, viz:

SIR: Your letter of the 30th May was submitted to the consideration of the War Department on the 4th instant, and was this day returned to this office, with the following endorsement:

"The views of Col. Long submitted herewith are approved, with the following exceptions:

"The department considers the office of agent for the construction of snag-boats, &c., held by Capt. Russell, as superseded by the assignment of Col. Long to the superintendency of the western river improvements; and unless his services in that capacity are especially desired by Col. Long, they will be dispensed with. The recommendation for Capt. Russell's employment in the *general* direction of the removal of snags, &c., is not approved.

"The appointment of Chas. Daulton, agent for the improvement of the Illinois river, is revoked.

"If a disbursing agent is required, Col. Long's attention is drawn to the recommendation herewith transmitted of Hon. J. A. McLemara and others in favor of George A. Dunlap."

J. J. ABERT,
Col. Corps Topographical Engineers.

Lieut. Col. LONG.

In reference not only to the paragraph above considered, but to all the other paragraphs into which I have divided Capt. Russell's letter, it is worthy of remark that no reference has been made to any of the numerous orders and instructions I had occasion to issue to Capt. Rus-

sell for his information and guidance, all of which were known to have been put into the hands of Capt. Russell, not only by himself, but by Thos. D. Tilford, the writer of the letter.

Having thus disposed of the leading topics adverted to in paragraph No. 1, I proceed to the consideration of

Paragraph No. 2.

At a meeting of the snag-boat captains, held on the 21st July at headquarters Western River Improvements, at which Capt. Russell was present, inquiry was made with respect to the sufficiency of the equipment and outfit of the several snag-boats, when it appeared that both equipment and outfit were far from being adequate to the exigencies of the snag business, although Capt. Russell had repeatedly declared that the boats were completely equipped and ready for service long before that date. Accordingly, a list of all the articles required for each boat was at once prepared by the captains, under my personal direction, and Capt. Russell was directed to procure the articles specified in the list in quadruplicate, with the least possible delay, and cause said articles to be delivered on board of the respective boats for which they were procured.

The duties thus assigned to Capt. Russell seem to have been regarded by him (to say nothing of Mr. Tilford) as onerous in a high degree. The occasion called for speedy action. The river was rising, and expected to be at a stage sufficiently elevated to admit the descent of the boats in a very few days. The equipment of the boats was not sufficiently complete; they had not yet been supplied with a full and proper complement of provisions. It was too late to remedy the evils without extraordinary exertions, which might and ought to have been obviated by prudence, forecast, and previous action on the part of the agent.

The articles called for as above were embraced in a general requisition to be supplied by Capt. Russell. In addition thereto, a special requisition was prepared for each boat, providing for other articles which were required specially to complete its individual outfit. The special requisitions were filled by the captains, and the payments required by each were made and accounted for by myself.

In the months of May and June I repeatedly requested Capt. Russell to have the boats completed and supplied with all necessary articles of equipment and outfit, and ready for service at the earliest practicable date, and was as often assured by him that all things were in readiness for the departure of the boats whenever I should think proper to give orders to that effect. About the middle of July he reiterated the same assurances; but on an examination of the boats, &c., which took place about the 20th July, in presence of Capt. Russell and the captains of the boats, it was found that the articles provided for in the general requisition above mentioned, which Capt. Russell was directed to fill, and in the special requisitions which were to be filled by the captains, were still essential, and must be procured in order to complete the equipment and outfit of the boats; and the haste enjoined in procuring and delivering the articles on board was rendered imperative by the fact that a rise in the river had then commenced, and was likely to be

at its maximum in a very few days thereafter, when the boats must take their departure for service, or be detained many weeks longer, perhaps, waiting for another freshet.

At the same time Captain Russell, in the presence of the captains of the boats, was distinctly informed that, in accordance with instructions from the War Department, a change in the administration of the affairs of western river improvements must speedily take place; that the boats, &c., must be transferred to the command of the captains; and that his agency proper must cease on or before the departure of the boats for service in the Mississippi, &c.

The hurry and complexity of the business complained of by Capt. Russell in this paragraph, would never have been entailed or enjoined upon him but for his neglect to make proper preparations for the departure of the boats in due time, for which ample opportunity was afforded by the detention of the boats by low water during one month at least, viz: from the 20th June till the 20th July.

In the month of June, after having become satisfied of the utter incompetency of Captain Russell as an accountant, and under the conviction that I was not empowered to revoke his appointment as United States agent, I had some conversation with him on the employment of a clerk, at a compensation, exclusive of travelling expenses, not exceeding \$50 per month. But no authority was ever given beyond a mere suggestion that he (Captain Russell) should be on the alert to find some young man of enterprise, qualified for such employment. But on learning the views of the Secretary of War in reference to the continuance of Captain Russell in the public service, viz: on the 15th of July, the subject of employing such a clerk was totally abandoned.

Paragraph No. 3.

On or about the date last mentioned under the preceding head, Captain Russell was informed that, on the expiration of his agency proper, as before mentioned, he would be continued in service as my assistant, and at a compensation of \$5 per day, from the departure of the boats till all liabilities and accounts contracted by him, in the discharge of his functions as United States agent, should be cancelled and settled; which it was expected might be readily done in two or three weeks—certainly before the 1st of the ensuing September, when my annual report would become due, in which a statement of his accounts must be exhibited.

Captain Russell was distinctly informed that the settlements required of him, as above, should embrace only such amounts as related to expenditures and liabilities incurred by him prior to the 27th July, and that all the accounts of a subsequent date relating to western river improvements, viz: from and after the 26th July, would be settled by myself personally.

Paragraph No. 4.

This paragraph begins with a palpable and gross perversion of time and date. The first, and I believe the only written instructions issued

by me in relation to his employment as my assistant, are contained in my letter of instructions to Captain Russell, under date of June 14, 1853, the twenty-second item of which is as follows, viz:

"22d. In your capacity of United States agent for the improvement of the Mississippi, Missouri, and Arkansas rivers, you are also regarded as an agent and assistant to the superintendent of western river improvements, and are accordingly authorized to exercise a *general* supervision and control over all snag-boats operating on said rivers; the special command of each boat in the prosecution of the snag business, and of the officers and crews attached to the same, being *reserved* and *confided* to the captain of the boat, who is entitled to the exercise of all the privileges and authority vested in him agreeably to items 5th and 6th of the preliminary regulations;" a copy of which had been furnished to Captain Russell.

The subject of Captain Russell's employment as assistant to the superintendent was no doubt occasionally discussed in conversations between him and myself from the date above mentioned to the middle of July; when in conformity to the instructions before cited, under paragraph No. 1, the assistance previously expected from Capt. Russell was restricted exclusively to the settlement of his accounts; in which he was to serve, not in the capacity of United States agent, but in that of my assistant, for the performance of specific duties, his agency having ceased on the 26th day of the same month, and his functions having been restricted to the settlement of his accounts.

Paragraph No. 5.

This paragraph commences with an apology in behalf of Mr. Tilford, for having violated his engagements with me, after a brief notice of three or four days only, and at a time when I deemed his services utterly indispensable; being only fifteen days prior to the date when my annual report would become due, in the preparation of which Mr. Tilford was the only individual on whom I could rely for assistance in the compilation of that intricate and complicated document.

I do not deny that I was exceedingly chagrined and embarrassed by this sudden and unexpected movement; but I disclaim and repudiate the idea that I felt or manifested any want of kindly feeling towards Captain Russell on this account.

Notwithstanding the autographic eulogium on Mr. Tilford, the faithfulness and integrity of this gentleman may be inferred from his sudden withdrawal from my employ, and from the fact that for his services in this office, till the time of his withdrawal, he was charging at the rate of \$1,200 per year, and at the same time, for extra services under Captain Russell, actually charged at the rate of \$1,000 per year. He nevertheless wrote an excellent hand, copied with accuracy and despatch, and was a good accountant, but was by no means remarkable for industry and close or careful attention to business during my absence from the office. For example, from the 22d of June to the 15th of July, during my absence, I left him in charge of my office, of the arrangement of papers pertaining thereto, of the preparation of model accounts for the clerks of the snag-boats, and of bringing forward the

office records in chronological order, none of which were executed in a satisfactory manner.

The assertion that "I then, for the first time, told him (Captain Russell) that he could not be continued in any capacity in the employment of the government," and that I then, *for the first time*, intimated that such was the decision of the Secretary of War; also, "that he asked me to discharge him in writing," and say that it was done by the direction of the Secretary; "that I refused to discharge him," and that he continued in service as heretofore, by my express directions, are dicta that savour much more strongly of fiction than of facts, as may readily be perceived from the remarks already exhibited in this paper: at any rate, there is not a single circumstance in my recollection, and not a single document among the archives of this office, that in the slightest degree corroborates either of the assertions.

Paragraph No. 6.

The assertions in this paragraph are no less fabulous and unfounded than those of the preceding paragraph. I referred the extra allowances claimed for his clerk to the Topographical Bureau without any refusal on my part, as will appear from an inspection of my report accompanying Captain Russell's accounts for the second quarter of 1853, in which the following remarks are contained, *viz*: "In voucher No. 4 of my official accounts, under the head of western river improvements for the second quarter of 1853, a compensation at the rate of \$1,200 per year, from the 10th of May to the 30th of June, amounting to \$170, has been introduced as an allowance to Mr. Tilford for his services as clerk, which is in accordance with my agreement with him." "In voucher No. 2 of Captain Russell's accounts, herewith, under the head of improvement of the Mississippi in the same quarter, (second quarter of 1853,) a compensation at the rate of \$1,000 per year, *viz*: \$250, has been introduced in favor of Mr. Tilford for his services as clerk to J. W. Russell for the whole of the same quarter, (second quarter of 1853.)"

"The latter compensation seems to be claimed by Mr. Tilford, on the score of his having performed the services last mentioned *out of office hours*. Deeming this charge in part, if not wholly inadmissible, I take leave to submit the question to the decision of the Topographical Bureau, while, at the same time, I am ready to admit that the services of Mr. Tilford have been in a high degree arduous."

At the time of employing Mr. Tilford he was serving in the capacity of clerk to Captain Russell, at a salary of \$1,000 per year. I engaged his services, which were to commence on the 10th day of May, at a salary of \$1,200 per year, with the express understanding that Captain Russell's office would soon thereafter be removed to headquarters of Western River Improvements, and that all clerical duties required thereat would be performed by him under my direction. The increased salary allowed by me was deemed sufficient to compensate for any extra services required of Mr. Tilford.

With regard to office, and office rent, my orders of the 8th and 14th of June, neither of which was ever revoked, show the fallacy of the as-

sertions that "I positively directed him to keep his office where it was, and then to close up the business."

Mr. Tilford may have been employed on a very few occasions eight hours per day, as intimated in this paragraph, but his average daily attendance at the office was certainly less than six hours per day, exclusive of several instances of absence on leave for two or three days at a time, and occasionally by reason of indisposition.

Paragraph No. 7.

With regard to the validity of Captain Russell's claim for clerk-hire, office rent, and salary, enough has already been advanced under the preceding heads.

The agency of Captain Russell, so far as I have had anything to do with it, terminated with the 26th day of July last. From that date to the 3d of September following I recognised him in service in the capacity of an assistant, and after the date last mentioned I regarded him as entirely disconnected with the public service, as has been clearly shown in this paper.

Paragraph No. 8.

The accounts of Captain Russell for the period commencing on the 1st of July and terminating on the 26th of the same month (the latter being the date at which his agency ceased) exhibited the balance stated in this paragraph, viz: \$297 56, as remaining in his possession. This balance resulted from a comparison of his debits and credits as exhibited in his accounts for that period. The balance, however, has been incorrectly stated, by reason of the charges allowed by him for extra clerk-hire, not only for the period above mentioned, but for that intervening between the 10th of May and the 30th of June, inclusive; hence, instead of the balance in his possession as above, (viz: \$297 56,) the balance remaining in his possession after the 26th of July (on the supposition that his accounts were in all other respects correct) should have been as follows, viz:

Balance in the hands of Captain Russell, as above.....	\$297 56
Overpaid to Tilford for extra services in 2d quarter of 1853.	141 65
Do..... do..... do..... in the month of July..	72 18
Corrected balance in hands of Captain Russell after July 26, 1853	<u>511 39</u>

With respect to the allowance due to Captain Russell for his personal services from and after the 26th of July last, for extra clerk-hire and for office-rent from and after the same date, the whole subject was referred to the Topographical Bureau by me in my report of the 3d of September, which was submitted in company with Captain Russell's accounts for the 2d quarter of 1853.

All accounts received from Captain Russell have been forwarded to the Topographical Bureau.

For numerous other details in reference to the official proceedings, &c., of Captain Russell and Mr. Tilford, I beg leave to refer to numerous reports heretofore made to the bureau, and especially to my report of September 17th in relation to the instructions given to those gentlemen and to their non-compliance with the same; also of the 28th of the same month in relation to the accounts of Captain Russell for the month of July last.

Respectfully submitted:

S. H. LONG,

Lieut. Col. Top. Engs., late Supt. W. R. Improvements.

Col. J. J. ABERT,

Chief Top. Engineers, Washington, D. C.

P. S.—The letter of Captain Russell is herewith returned, agreeably to your request.

S. H. LONG.

No. 13.

LOUISVILLE, January 19, 1854.

SIR: I embrace the earliest opportunity to forward the accompanying transcript of the memoranda prepared for the use of Colonel Johnston, in conformity to instructions from the War Department.

Very respectfully, sir, your obedient servant,

S. H. LONG,

Lieut. Col. Top. Engs., late Supt. W. R. Improvements.

Col. J. J. ABERT,

Chief Top. Engineers, Washington, D. C.

Memoranda in relation to works transferred to the charge of Colonel J. E. Johnston.

HARBOR OF DUBUQUE.

J. Barney, esq., is the United States agent in charge of the improvement of this harbor.

The method of improvement was devised and adopted by said agent, agreeably to instructions furnished him by the chief topographical engineer.

Having never been furnished with an accurate chart of the harbor, and of the islands and channels adjacent to it, I am not prepared to give a decided opinion as to the merits or demerits of the method adopted for its improvement.

The method adopted obviously has for its object the opening of a navigable channel, leading from the main business landing of Dubuque, directly across the Mississippi to the contemplated terminus of the westerly branch of the Illinois central railroad. The channel in its passage from Dubuque must cross two considerable islands called the Inner and Outer islands; after which it will enter the main channel of

the Mississippi some four or five hundred yards from the town landing, and pass thence directly across the river to a landing near the proposed terminus of the railroad.

The channel hitherto pursued by ferry-boats crosses the islands above mentioned about 100 yards below the contemplated new channel, the former being quite crooked, and the distance by it being much greater than by the new channel. In crossing the lines of the island, the old channel pursues the direction of a natural channel, leading across the islands in a direction more or less serpentine till it reaches the main channel of the river. Circumstances render it doubtful in my estimation whether the enlargement and straightening of the old channel would not prove more efficacious than the formation of the new channel in the direction selected for that purpose.

The chart expected of Captain Barney will no doubt afford the means of deciding this question.

ROCK ISLAND RAPIDS.

The improvement of these rapids has also been committed to the charge of Captain Barney.

By instructions from the office of Western River Improvements, dated on the 1st of June last, for the survey of the rapids of the upper Mississippi (including the Rock Island rapids and the Des Moines rapids) Lieutenant Warren was directed to organize a party; and, with the requisite instruments, stationery, and other articles of outfit, to proceed to the rapids, and execute such surveys, &c., as might be deemed needful in determining the position, nature, and extent of the obstructions that must be removed in order to open a channel 200 feet wide, and four feet deep, in extreme low water from the head to the foot of both rapids.

The United States agents for the improvement of the rapids, viz: Captain Barney for Rock Island rapids, and Major Floyd for the Des Moines rapids, were directed to aid Lieutenant Warren, both by their counsel and co-operation, in the execution of the surveys at both rapids if practicable, and especially at the rapids committed to their individual charge respectively.

The field and river work of the survey of Rock Island rapids has been completed, and the drawings, &c., explanatory of the survey, are now in progress.

A joint report from the three individuals above mentioned was expected; instead of which an individual report has been received from Lieutenant Warren, in which nothing has been stated in reference to the counsel or co-operation of his colleagues. In reply, Lieutenant Warren has been directed to submit a transcript of his views, as contained in his report, to Messrs. Barney and Floyd; and these officers have been requested to signify in writing their concurrence or otherwise with the views set forth in his (Lieutenant Warren's) report.

A transcript of the notes and drawings prepared by Lieutenant Warren, on the survey of the Rock Island rapids, has been put into the hands of Captain Barney, and he is now engaged in the construction of a chart of the rapids for use in the improvement of the same.

Captain Barney has publicly called for sealed proposals for the execution of the work of improvement, which were to be made on or before the 1st of November; but on that date no proposal had been received, and no offer been made, except for the removal of a single obstruction, presenting an area of only about eight feet square, for the removal of which \$250 was the lowest offer made.

DES MOINES RAPIDS.

Major John G. Floyd has been appointed agent for the improvement of these rapids, and has been employed on the survey of the same, as also for that of the Rock Island rapids, from the latter part of June to the present time. His compensation for services and transportation to the close of the month of October has been defrayed out of the general fund appropriated for the improvement of the rapids of the upper Mississippi, on my personal requisition.

Agreeably to instructions from the Topographical Bureau, Major Floyd has been recognised as United States agent for the improvement, but not as disbursing agent. Hence I have conceived it proper for me to remunerate him for his services, &c., up to the date last mentioned.

The work of improvement at these rapids was commenced by Col. R. E. Lee in 1838 or 1839, and prosecuted during the low-water stages of one season only, when it was suspended for want of an appropriation. The benefit resulting from the work done consisted in the production of an increased depth of channel across the rapids of about ten inches, at a cost of which I have never been informed.

The survey of the rapids is at this time nearly completed. A sketch or chart illustrating their condition, channels, &c., at the Lower and English Chains, has been prepared by Lieutenant Warren; and the same officer is expected to complete the surveys in the course of a few days, repair with his notes, &c., to headquarters at Louisville, and there complete his drawings, reports, &c., explanatory of the work committed to his charge.

Major Floyd has already called for proposals for the improvement of the Lower and English Chains of the rapids, but as yet has received no encouragement to expect satisfactory bids for the work.

ILLINOIS RIVER.

George A. Dunlap, esq., has been appointed disbursing agent, and Major G. W. Long engineer, for the improvement of this river.

Surveys for determining the position and character of the natural channel, and the meanderings, &c., of the river, were commenced by Major Long in the latter part of August, and have been executed on a distance of about 60 miles, from the mouth of the river upwards to Naples.

The results obtained are very different from those anticipated. Instead of broad flat bars extending entirely across the river, all the bars that have been surveyed are traversed by narrow, crooked channels, at least four feet deep in the present low stage of the river.

The dredge-boat No. 2 (the Gopher) was ordered from the Ohio to

the Illinois river about the middle of October, and commenced operations in the latter river in the latter part of that month. The progress made in dredging since that time has not yet been reported.

This dredge-boat (Gopher) is probably engaged in dredging at this time at the Naples bar, about 65 miles above the mouth of the Illinois.

THE SNAG BUSINESS.

The rivers on which the exigencies of existing commerce call for the prosecution of this business are as follows, viz :

The Mississippi, from Keokuk to Donaldsonville, embracing an aggregate distance of about 1,350 miles; the Missouri, from its mouth to Council Bluffs, embracing a distance of about 700 miles; the Ohio, from its mouth to Wheeling, about 900 miles; and the Arkansas, to Fort Smith, about 550 miles; making the aggregate extent of the rivers requiring the removal of snags, &c., about 3,500 miles.

On the Mississippi, between the mouth of the Missouri and Keokuk, snags and sunken logs, especially in the low-water channels, are of rare occurrence, yet steamers are occasionally injured and sometimes wrecked by collisions against obstructions of this character.

No portion of this river, of equal extent, presents more frequent and formidable obstructions than the middle Mississippi, extending from the mouth of the Missouri to that of the Ohio.

From the point last mentioned downward to the mouth of Red river, snags and logs of a dangerous character are presented at almost every bend of the river; and thence downward, even to Plaquemine, are occasionally to be met with.

In the Missouri, snags are of more frequent occurrence than in the lower Mississippi, and are generally more difficult of removal, by reason of their being more deeply imbedded in the sandy bottom of the river.

The Missouri is seldom at a stage suitable to the prosecution of the snag business more than six or eight weeks in the course of the year, being prevented by frosts and freshets from an early date in November till about the middle of July, and by the lowness of the water from an early date in September till the commencement of cold weather in November.

The Ohio is less obstructed by snags than any portion of the rivers above mentioned; yet snags, wrecks, and sunken logs of a very dangerous character are occasionally to be met with in this river.

The snags of the Arkansas are exceedingly numerous and formidable, while the prosecution of the snag business therein is rendered far more difficult and precarious by reason of the sudden and frequent changes in the depth of the river, the narrowness and crookedness of its channels, the rapidity of its currents, the compactness of its bars and bed, and the depth to which the snags are imbedded.

The snag business can be prosecuted to best advantage in the months of April, May, June, and till the middle of July.

During the prevalence of the spring freshets, viz: from the latter part of February to the middle of April, the Ohio, Mississippi, Missouri, and Arkansas, are generally too much swollen to admit of a beneficial

prosecution of the snag business, and it has accordingly been customary to withdraw the boats from the business and moor them in ports where they can receive needful repairs. St. Louis, Louisville, and Paducah have hitherto been found the most suitable and convenient positions for such purposes.

SNAG-BOATS.

Four twin snag-boats, numbered from 1 to 4, inclusive, have been assigned to the removal of snags, &c., from the Mississippi, Missouri, and Arkansas rivers.

These boats have been confided to the command of captains appointed by the express sanction of the Secretary of War. The duties of the captains have been prescribed and adopted by the same authority.

The captains are invested with the privilege of appointing all the officers and crews of their respective boats, subject in all cases of appointment to the approval or otherwise of the superintendent.

The captains are moreover invested with the power of discharging any individuals under their respective commands for disorderly conduct or misdemeanors of any sort, against which provision has been made in the rules and regulations prescribed and adopted, as above mentioned.

In accordance with the rules and regulations, the compensations to the officers and crews have been limited as follows, viz:

To a captain and 1st mate, conjointly.....	\$200
" pilot and assistant pilot, conjointly.....	175
" first and second engineer, conjointly.....	180
" competent clerk and accountant.....	90
" second mate.....	35
" carpenter.....	70
" striker and assistant blacksmith.....	40
" steward.....	35
" cook.....	30
" laborer.....	23
" washerwoman.....	15
" cabin-boy.....	15
" clerk.....	50

The complement of officers, men, &c., required for each snag-boat, is as follows: one captain; one first mate; one second mate; one pilot; one assistant pilot; one first and second engineer; one striker; one carpenter; one steward; one clerk; one cook; one washerwoman; one cabin-boy, and about twenty-six laborers—in all forty individuals.

In reference to the clerk it should be observed, that his qualifications should be such as to enable him to keep, in a neat, clear, and legible manner, all minutes relating to the work done and the proceedings had on board of the boat, in so far as they relate to the public service; and to prepare and render, in a business-like manner, all accounts relating to supplies of all kinds required for the boat, and to report the

same in due form to the superintendent. In the event of an adequate compliance with the requisites above stated, he is authorized to expect the compensation hereinbefore mentioned; otherwise his compensation is to be such only as the superintendent may think proper to allow.

Conventions of steamboat pilots, recently held at St. Louis and other cities of the West, have agreed upon and established rates for pilotage much higher than those sanctioned by the Secretary of War; and, in one instance, at least, the allowance for pilotage has been increased to \$250 per month for the chief pilot; but in this case, the services of an assistant pilot have been dispensed with.

The plan of administration, the rules of police, &c., in so far as relates to the management of the snag flotilla, are set forth with sufficient clearness in the printed articles of enrolment.

The snag-boats having been completed and ready for service on the 26th of July last, and the Ohio being at a stage sufficiently elevated for the boats to descend to its mouth, the captains were directed to take their departure from Louisville on the summit of the freshet then occurring, which was done on the 29th of the same month; when the boats commenced service for the season.

The snag flotilla thus despatched for service consisted of the following twin snag-boats; to which the names of their captains and first mates are respectively annexed, viz:

- No. 1. H. R. Day, captain; Frederick Saunderson, first mate.
- No. 2. Thomas Riddle, captain; Robert King, first mate.
- No. 3. N. M. Ferguson, captain; Hicks King, first mate.
- No. 4. H. Fendren, captain; J. Y. Clemson, first mate.

These several boats, with their equipments and articles of outfit on board, and with their officers and a force on each sufficient to work them on their voyage down the river, took their departure from Louisville on the 29th July, all on the same day and date. No. 2, commanded by Captain Riddle, unfortunately grounded on a sand-bar at the foot of French island, on the evening of the 30th of July, and was unavoidably detained till the 12th of September following; while the other boats succeeded in descending the river to its mouth. No. 1 and No. 3 were assigned to service in the Missouri and middle Mississippi, and Nos. 1, 2, and 4, to service in the Arkansas and lower Mississippi.

The rules and regulations prescribed for the government of all engaged in the service are contained in the printed regulations before referred to; in addition to which, general and special instructions have been issued from time to time in manuscript by the superintendent.

The work done by the boats has been exhibited in monthly time-rolls and journals; all of which have been kept on file in the office of Western River Improvements, at Louisville.

To the snag-boats above noticed should be added a fifth, called the Terror, (No. 5) which was placed in charge of C. A. Fuller, esq., and employed in removing snags, wrecks, &c., from the Ohio, above the falls. This boat is of much smaller dimensions, and of much less substantial construction, in all respects, than either of the others.

The points of operation and the work done by No. 5, are exhibited

in returns made by the agent above named; all of which are exhibited in the records or among the files of the office above mentioned.

Dredge-boats and mud-scows.

Two dredge-boats, with four scows and one yawl for each, have been constructed for service relating to the improvement of the western rivers; one of which, with its scows, &c., commenced the work of dredging in the harbor of Dubuque, on the first of July, under the direction of J. Barney, esq.; and the other at Cumberland island, about the middle of the same month, under the direction of C. A. Fuller, esq.

The dredge-boat employed at Dubuque has been designated by the name of George W. Jones, or No. 1; and that at Cumberland island by the name of Gopher, or No. 2.

About the last of October the Gopher (No. 2) was transferred from the Ohio to the Illinois river, in which she is now operating in widening and deepening the channels, under the direction of Major George W. Long, engineer, and George A. Dunlap, esq., disbursing agent for that river.

This dredge-boat is now for service in the Illinois river, between Naples and its mouth, and will probably be employed in dredging the channel of the river between these points during the residue of the current year.

The dredge-boat No. 1 (George W. Jones) remains at Dubuque, and will probably continue unemployed, the funds appropriated for the improvement of the harbor at that place having been nearly exhausted.

Snag-boat No. 1.

Agreeably to the journal kept on board, the No. 1 ascended the Missouri to Smith's bar, about 160 miles from its mouth, and removed many of the most serious obstructions to low-water navigation on that portion of the river. The river then becoming too low for further operations in the Missouri, the boat returned to the Mississippi and resumed operations in the latter river, and has continued to operate between the mouth of the Missouri and that of the Ohio till the present time, having rendered efficient service in both rivers, and especially in the Mississippi, the low-water channel or shoals of which is said to be more effectually cleared of snags, &c., than it has ever been known to be at any former period.

Snag-boat No. 2.

This boat grounded on a sand-bar, near French island, on the 30th of July, and was unavoidably detained till the 12th day of September following. She then proceeded downward to the places designated for the operations, viz: in the Arkansas and Mississippi rivers; the former of which being at a stage too low to admit her entrance, she commenced operations in the latter, at and near the mouth of the former.

Since that time, she has operated to great advantage from the place of beginning downward about 75 miles, to Greenville, and upward to

island No. 24, near Ashport, about 130 miles below the mouth of the Ohio, where she was employed on the 20th of November, 1853.

The force on board has generally been less than the ordinary complement, viz: 40 individuals, and occasionally not exceeding half that number. Her present force does not exceed 28 efficient individuals.

Capt. Thomas Riddle was at first appointed to the command of No. 2. The appointment was subsequently revoked, and Capt. J. W. Leathers was appointed in his stead. Capt. Leathers declined to accept the appointment, and Capt. Riddle was retained in the command till a new appointment should be made. Early in November, — Greathouse, esq., was appointed captain of No. 2, and is expected to supersede Captain Riddle in the course of the present month, (November.)

Snag-boat No. 3.

This boat commenced service at the same time and at the same place with No. 1, viz: at the mouth of the Missouri, both having been assigned to operations in that river, and in the middle Mississippi. She ascended in the former river about 160 miles, to Smith's bar, and after operating to advantage in that river, was compelled to retreat to the Mississippi by reason of low water.

She then resumed operations in the Mississippi, and was employed successfully in removing snags, &c., from the middle Mississippi till the middle of October, when she was instructed to operate between the mouth of the Ohio and island No. 18, about 130 miles below, where the snags and other obstructions were exceedingly numerous and formidable.

At this time, she has accomplished the removal of the snags from the low-water channel, very effectually, through the entire distance just mentioned, and is now in readiness to be transferred to service at any other desirable points.

The force now on board the boat considerably exceeds the complement required for service.

This excess has been occasioned by the enrolment of hands to supply desertions, and by the receipt of a force from abroad larger than was expected at the time.

Snag-boat No. 4.

This boat commenced operations in the Arkansas early in August, and operated through a distance of about 60 miles from the mouth of the river upward, when she was compelled to retreat from that river by reason of low water. On her retreat, however, she unfortunately grounded on a sand-bar a little below the White river cut-off, and was there detained for one entire month.

The detention was attended by much sickness among the officers and crew, which served to reduce the available force on board from a full complement of healthy and energetic men to some 15 or 20 who remained fit for duty. Two of the hands died on board, and the others, for the most part, were more or less enfeebled and dispirited by disease. The captain, clerk, and several other officers, were much indisposed and ill fitted for energetic service.

The officers and crew remained in the disabled condition above mentioned till about the middle of October, when many of the sick were discharged, several of the laborers deserted, and the force on board was too much reduced to admit of operating with the boat for several days.

New recruits were, however, obtained from above in the course of a few days, and operations were resumed again about the 20th of October, since which time the boat has been successfully employed on the Mississippi, from Napoleon upward to island No. 37, through a distance of about 240 miles.

It is due to James Y. Clemson, esq., first mate of No. 4, to observe that the successful operation of the boat is due mainly to his experience, knowledge, and skill, in the prosecution of the snag business.

OHIO RIVER, INCLUDING CUMBERLAND DAM.

The improvements under this head have been committed to C. A. Fuller, esq., as United States agent therefor, and embrace the following works and operations viz:

The removal of snags from the river generally; the enlargement of Cumberland dam, and the dredging of the channel in its vicinity and at such other points as may need that operation; the survey of Marietta harbor, with a view to the best method of improving the same; and such other duties relating to the works above mentioned as may be deemed needful by the superintendent or War Department.

A twin snag-boat, of light draught, has also been committed to the charge of C. A. Fuller, for the purpose of removing snags, wrecks, &c., from the low-water channels. This boat (snag-boat No. 5) has been successfully employed in clearing the channel above the falls, from an early date in May till about the last of July, when she was compelled to lie by for want of a sufficient depth of water in the river to admit of further operation.

During her detention as above she has been subjected to such repairs and alterations as were deemed needful.

She resumed operations on the upper Ohio early in November, on the occurrence of a rise in the river sufficient for that purpose. On the 1st of the same month, the river was sufficiently elevated to admit her to cross the falls, and since that time she has been engaged in removing snags, &c., from the lower Ohio.

The enlargement of Cumberland dam has been prosecuted under a contract nearly to its completion; but the appropriation for the Ohio, including this work, has proved inadequate to the accomplishment of both of these objects, and, in consequence, the dam has been left in an unfinished state.

The dredge-boat Gopher, (No. 2,) which was constructed under the direction of C. A. Fuller, was employed in dredging the channel between Cumberland island and the Kentucky shore, and also in opening a channel across the bar below the foot of the same island, with success at the former, but to little advantage at the latter locality, its efficiency having been prevented by the frequent passages of steamers through the channel at which she was operating.

Surveys have been made at Marietta and its vicinity under the direction of the same agent, for the purpose of showing the best method of improving the harbor at that place.

The drawing and report on the survey have not yet been furnished by the agent.

In addition to the printed rules and regulations before mentioned as having been prescribed for the government of all engaged in western river improvements, instructions have from time to time been issued from headquarters of Western River Improvements for the guidance of the officers and men employed in this service, copies of which are contained in the registers and files in the office of Western River Improvements at Louisville, all of which are transferred to Colonel Johnston.

In accordance with instructions from the War Department, the foregoing memoranda are furnished for the information of Lieut. Col. Johnston, superintendent western river improvements.

S. H. LONG,

Lt. Col. U. S. A., late Supt. W. R. Improvements.

LOUISVILLE, November 28, 1853.

No. 14.

LOUISVILLE, February 20, 1854.

SIR: Your letter of the 13th instant, enclosing a communication from the honorable B. Henn, of Iowa, was received on Saturday, the 18th instant.

In accordance with your instructions, I have the honor to submit the following report on the letter in question:

Two years will have elapsed since the approval of the appropriation for the improvement of the rapids of the upper Mississippi on the 30th of August next—six months hence. The expenditures under this appropriation were committed to my charge on the 27th of April last—less than eleven months prior to this date.

Instructions, explaining and defining the manner of executing the requisite preliminary surveys and the agents by whom the surveys were to be made, were issued by me under date of June 1, 1853, and a copy of the same was reported in due time to the Topographical Bureau. These surveys, and the delineations required in explanation thereof, were indispensable as a means of defining the nature and extent of the work that must be done at the several points at which improvements were required.

The working drawings executed under the direction of Colonel Lee, in 1839, could nowhere be found, and of course new surveys and drawings were essential to the resumption of the work fourteen years afterwards.

It is accordingly manifest that the work of improvement could not be commenced till the surveys should be made and the explanatory drawings should be prepared, which have contributed to delay the works to the time when I was relieved from the superintendency of western river improvements by Colonel Johnston.

Numerous reports have been submitted by me to the Topographical Bureau, in which a clear exposition has been made of all operations affecting the improvement of the rapids under my superintendency.

To these reports, and especially to my eleventh annual report, with its appended documents, of the 1st September last, and to my inspection report, dated on the 20th December last, I take leave to refer for various useful details in relation to the subjects of the inquiry instituted in the letter of the honorable member of Congress from Iowa. Without a laborious examination of the office records of western river improvements, all of which have been transferred to the custody of Colonel Johnston, I cannot now furnish the details asked for by the honorable gentleman.

With regard to the queries predicated on a clause of my report to the board of engineers, dated at Washington on the 23d of February, 1853, and in relation to certain "modes of improvement informally proposed," I take leave to offer the following remarks, *viz.*:

Within a period of thirty-six years, I have had occasion to visit the upper Mississippi repeatedly in the discharge of official duties. On such occasions the improvement of the rapids has been a topic of conversation between myself and numerous individuals who took a deep interest in the accomplishment of this object. Each individual, as might naturally be supposed, entertained favorite views in reference to the best method of improvement. The methods thus "informally proposed" consisted for the most part of the modes contemplated in my report above cited. But with respect to the contingents, "*where, when, and by whom,*" the several methods were discussed or proposed, I cannot define with accuracy. It may suffice to remark, that at one time I was in favor of a lateral canal, with locks, on the Illinois side of the river, especially at the Des Moines rapids; subsequently, I inclined to the opinion that the Iowa side of the river was better adapted as the site of a similar canal; and on more mature deliberation, I came to the conclusion that the method proposed and recommended in my report of 23d February, just before cited, and for the reasons therein stated—the method by sluice navigation—was preferable to that by lateral canals on either side of the river, and especially to that by slack-water navigation, effected by means of locks and dams across the river. I claim not the credit of having originated either of the methods alluded to; and at the same time disclaim, as I usually have done, the application of any method of improvement that would have a tendency to destroy or even impair the natural navigation of the river in which improvements may be required.

In conclusion, I can assure you that nothing has been done, and no expenses or delays have been incurred, except in so far as relates to the discovery of the most favorable localities for the opening of channels best adapted to sluice navigation within the low-water margins of the river at both of the rapids.

Very respectfully, sir, your obedient servant,

S. H. LONG,

Lieut. Col. Top. Engs., late Supt. W. R. Improvements.

Col. J. J. ABERT,

Chief Top. Engineers, Washington, D. C.

Dr.

Lieutenant Colonel S. H. Long in account with Lieutenant Colonel J. E. Johnston.

Cr.

1853.		1853.		
Nov. 1	To unexpended balance on hand, as per account current, dated October 1, 1853, on account of western rivers.....		Oct. 8	By amount of H. Fendren's receipt transferred.....
1	To unexpended balance on hand, as per account current, dated October 1, 1853, on account of improvement of Mississippi river.....	\$8,565 55	8	By amount of Thomas Riddle's receipt transferred.....
1	To unexpended balance on hand, as per account current, dated October 1, 1853, on account of improvement of Arkansas river.....	7,921 25	14	By amount of N. M. Ferguson's receipt transferred.....
1	To unexpended balance on hand, as per account current, dated October 1, 1853, on account of improvement of Missouri river.....	3,641 68	14	By amount of H. R. Day's receipt transferred.....
1	To unexpended balance on hand, as per account current, dated October 1, 1853, on account of improvement of Illinois river	3,573 85	15	By amount of H. R. Day's order in favor of T. S. Brown.....
		439 55	29	By amount of Colonel Johnston's receipt transferred.....
			Dec. 3	By cash advanced snag-boat No. 1.....
				By amount overpaid on account of improvement of rapids of upper Mississippi, per abstract and vouchers transferred.....
				By Lieut. Col. S. H. Long's transportation allowance, per voucher.....
				By Lieut. Col. S. H. Long's com. quarters and fare, per voucher.....
				By Lieut. Col. S. H. Long's office rent and fuel, per voucher.....
			24	By amount paid C. Basham, jr., per voucher
			24	By cash advanced snag-boat No. 4
				By cash advanced snag-boat No. 3
				By balance delivered Colonel Johnston in cash, as per receipt
		24,141 88		6,843 46
				24,141 88

I certify that the above account current is correct in all respects, and the balances of the appropriations therein exhibited are correctly stated, and they cover the entire amount drawn by me under each appropriation, and the respective balances still remaining in my possession; also the final balance to be transferred to Lieut. Col. J. E. Johnston, superintendent of western river improvements, in conformity to orders from the War Department, dated October, 1853, is \$6,843 46.

S. H. LONG,

Lieut. Col. Top. Eng., late Superintendent of Western River Improvements.

Received, Louisville, January 6, of Lieut. Col. S. H. Long, late superintendent western river improvements, six thousand eight hundred and forty-three dollars and forty six cents (\$6,843 46) in full of above balance, and of all accounts relating to the improvement of western rivers.

J. E. JOHNSTON, Supt. W. R. I.

H. Doc. 104.

OFFICE WESTERN RIVER IMPROVEMENTS,
Louisville, Kentucky, April 6, 1854.

SIR: Having completed the drawings of the rapids of the Mississippi, constructed from surveys made by order of Lieut. Col. S. H. Long, topographical engineers, I have the honor to submit this report on the subject

The instructions required such surveys at the *lower rapids* (Des Moines rapids) and at the *upper rapids* (Rock River rapids) as were necessary to determine the best and most economical route along the bed of the river for forming a continuous navigable channel, 200 feet wide and 4 feet deep at the lowest stages. It is hardly necessary to state that this required an entirely new survey; the maps made in 1837 by Lieut. (now Brevet Colonel) Lee, of the engineer corps, being on too small a scale to exhibit the character and extent of the channels and their obstructions.

The time was too limited, with the means at hand, for a thorough survey of the river-bed, and it was determined, after a careful examination and consultation with some of the ablest pilots, to confine the more accurate survey to the vicinity of the channel now navigated. This channel is undoubtedly the most practicable one for improvement. The general flow and direction of the current is here, being obstructed in other parts by broad shoal reefs.

The soundings on the drawings are, therefore, confined mainly to the vicinity of the present channel, with a confidence that where they have not been made, the prospect for improvement is by far less favorable.

Angles were taken on the position of *each* sounding by two theodolites, and special care was taken to determine the edges of the channels and reefs wherever they were crossed by the lines of soundings. Every attention was paid to secure accuracy; and in order to exhibit the channels and reefs distinctly, the drawings were constructed on a scale of 32 inches to one mile. The line of four feet low water is delineated, and lines drawn to show the parts necessary to be removed. In the improvement thus designated, all short turns and cross-currents are avoided as far as is consistent with a due regard for economy.

Lower Rapids.

The foot of these rapids, beginning at Keokuk, about half a mile above the depot of the St. Louis Packet Company, extends up the river $10\frac{1}{2}$ miles. There are four principal chains, known as the Lower, English, Lamallee's, and Upper. The first three are nearly contiguous, and are divided into other reefs variously named. The Upper Chain is distant from Lamallee's by $2\frac{1}{2}$ miles, and this interval is comparatively unobstructed.

The rock composing the reefs is a compact stratified limestone, in which are flint and geodes, and interstratified with blue clay a few inches in thickness. The limestone strata are nearly horizontal, and vary in thickness from a few inches to three and four feet. A few large granite boulders are found on the rapids and along the shore. The width of the river is about one mile.

To connect the stations used in sounding, a survey was made of six

miles of the left bank, and $12\frac{1}{4}$ miles of the right bank. The levels taken along the latter show the fall, at low water, to be 21 feet from the head to the foot of the *obstructions*, and the average slope two feet per mile. This slope is, however, not uniform, the maximum being six feet per mile, and the minimum about two-tenths of a foot per mile.

The maximum range of the water-surface at the head of the rapids is $11\frac{3}{4}$ feet, and at the foot 21 feet. Hence, high-water fall $13\frac{1}{4}$ feet, and average fall 1.12 foot, per mile.

The velocity at *low* water nowhere reaches five miles per hour. At high water, though the total fall is less, it is more uniform, and the friction along the bottom is so much less in proportion to the volume of water, that the velocity is greatly increased, and must reach 7 miles per hour.

At present, steamboats of the least tonnage, drawing two feet, cannot pass at low water without imminent danger of getting fast on the rocks, and the navigation is entirely suspended, or performed only with lighters at a cost of from 75 cents to \$1 25 per ton. At this same stage there is three feet water on the bars above and below the rapids. As the river rises, the water increases on these bars more than on the rapids, owing to the greater width and slope of the latter.

The ratio is nearly expressed in the following table, supposing the channel on the rapids deepened to 4 feet at low water :

With 3 feet on the bars, there would be 4 feet on the rapids.

4 do.	do.	do.	4 feet 3 inches on the rapids.
5 do.	do.	do.	4 feet 7 inches on the rapids.
6 do.	do.	do.	5 feet on the rapids.
7 do.	do.	do.	5 feet 8 inches on the rapids.
8 do.	do.	do.	6 feet 6 inches on the rapids.

I endeavored to furnish a table showing the duration of each of these stages during several years, but could not obtain the data. It might be important to aid in deciding upon the maximum depth to be given to the improved channel, in order to adequately accommodate the commerce of the river at mean stages. This, however, has less importance at this time, as the improvement, unlike a canal constructed with adequate dimensions, may be extended at any future period without more expense and inconvenience than now.

The operations of Captain Lee, in removing the obstructions, were confined to the Lower and English Chains. Pilots say that he enabled steamboats to pass them drawing from nine to twelve inches more water than they could before. In addition to this, his examinations at Lamallee's Chain resulted in discovering the channel now used through the upper part of it, known as Spanish chute.

The effect of his operations at the "Omega Patch," (Lower Chain) was, besides deepening the water in the neighborhood, to make the current draw more forcibly upon it. The patch itself would all have been removed by him had the improvement been continued.

This locality, four-tenths of a mile from the foot of the rapids and 870 yards from the Iowa shore, is the most difficult to pass of any, owing to swift cross-currents, and boats grounded on it have great difficulty in getting off. It should be the first improved. The channel crosses over to the Illinois shore at Montebello, one mile from foot of

rapids. As we ascend, the next difficult pass (marked E") is at the foot of English Chain, two miles from foot of rapids, and 170 yards from Illinois shore. The next (marked B") is near the head of English Chain, about three miles from foot of rapids, and 200 yards from Illinois shore.

The next are on Lamallee's Chain, at place marked R, $5\frac{3}{4}$ miles from foot of rapids, 500 yards from Illinois shore; at place marked I and J, $6\frac{1}{2}$ miles from foot, 600 yards from Illinois shore; and at place marked G and F, head of Lamallee's Chain, $6\frac{3}{4}$ miles from foot, and 600 yards from Illinois shore. Above this the channel crosses over to the Iowa shore. The next pass is the Upper Chain, and here a continuous cut of about 800 feet will be required.

The improvement of the Upper Chain would immediately lessen the distance for lightering about four miles; this would not, however, much diminish the expense, which is mainly incurred in unlading and lading.

At the Upper Chain, and at the "Omega Patch," there is no four-feet channel, and a cut will be necessary. At the other passes named above, the channel is divided by narrow ledges, the removal of which will be comparatively easy.

The lower reefs of the rapids are materially affected by back-water from floods in the Des Moines river, four miles below. Owing to this, pilots, by trusting their marks at the foot of the rapids, venture up them, drawing more water than is found above. Sand-bars, acting as dams, also affect the water on the lowest reef, which becomes the most im-passable obstruction when long continued low water has removed the sand.

An accurate idea of the present channel can be had by inspecting the drawings, and renders further description unnecessary; and but a glance will be required to convince one of the facility with which it can be improved, and made adequate to meet the wants of commerce.

Captain Shreve, in his report in 1836, urgently recommends that these rapids be improved by excavating a channel 90 feet wide, five feet deep, along the Iowa shore, from Keokuk to Nashville, and through the Upper Chain, near the foot of Montrose island.

He states, "by pursuing this plan the navigator will have the shore for his guide, and cannot miss the channel at any stage of water. Consequently, it will not be necessary to excavate a channel more than 90 feet wide, which width can be more easily navigated than a channel 300 feet wide, following the meanderings of the natural channel that now exists between the reefs." Captain S. thinks the expense of excavating rock near the shore will be ten per cent. less than near the natural channel.

This mode of improvement has still many friends among river men, on account of the ease with which such a channel could be navigated under all circumstances; the objection to a perfect navigation of the natural channel improved, being its distance from the shore.

The survey was extended to embrace this shore channel. It is used wholly in towing lighters up the rapids. In its present condition, it is at the shoalest places, in low water, from 10 to 12 inches deep. It has never been improved, and the depth could be easily increased to 18 inches.

To make a channel four feet deep, we must begin at the foot of the

rapids, and excavate from 6 inches to $2\frac{1}{2}$ feet, almost continuously to the landing at Nashville, a distance of $7\frac{1}{2}$ miles. The total fall is 18 feet, average slope $2\frac{4}{10}$ feet per mile. The greatest slope the improvement would have, need not at any point exceed four feet per mile. Above Nashville the improvement should be made as indicated on the drawings.

This plan is more economical, and for the purposes of navigation preferable in every respect to that of a canal and locks.

A fatal objection to both is, that all the labor bestowed upon them would be worthless till the whole was completed; and the great oppression which these rapids cause to commerce, requires that *immediate relief* which can only be applied by improving the natural channel, beginning at the worst passes first. This should be done, no matter what may be the improvement finally required, and no attempt should be made to widen any portion beyond 100 feet till the whole is made of this capacity.

The channel marked out on the drawings will be, when improved, nearly straight, crossing the river but twice, and then in *pools*, where the current is moderate. Any estimate of the amount of rock that will require removing in order to effect this, must at best be a very rough one. Former experience shows, that to remove a portion of a stratum we must remove the whole of it; that is, if in deepening a part now having three feet water, we should come on a stratum two feet thick, we must remove it all, and make five feet water. How much this may increase the quantity to be removed, can only be known by experience.

Even more unreliable must be an estimate of the cost of removing a given amount. The work can only be carried on during a limited portion of the year—three months at most, (August, September, and October;) and after every preparation has been made, an unfavorable condition of the river may almost, if not entirely, prevent operations, and all the expense will have been of no avail.

Captain Lee was not able, owing to continued high water and early fall, to work more than twenty days in 1838. He reports the amount of excavation at about 318 cubic yards. He had a most favorable season in 1839, of about three months. In his report of this year, it is stated that the amount of stone removed is something more than 2,000 tons, about 1,027 cubic yards; total for both years, 1,345 cubic yards.

The actual expense of removing this amount of rock was, in 1838, \$29,028 32; and in 1839, \$18,924 98—total, \$47,953 20. The average cost, then, was \$35 72 per cubic yard; or, for the favorable season, \$18 42 per cubic yard.

From the more settled condition of the country, and the facilities it affords, together with the advantage of former experience, we might now expect to remove the rock at \$10 per cubic yard.

The following table shows the amount of rock to be removed in making the natural channel four feet deep:

Locality.	Present width of 4-foot channel.	Amount to be removed to make it 100 feet wide.	Amount to be removed to make it 200 feet wide.
<i>Upper Chain.</i>	Feet.	Cubic Yds.	Cubic Yds.
Cut A, (800 feet long) only 2½ feet water		2, 970	8, 900
Point B	30	730	4, 040
Point D, (Baptiste's reef)	200	10	1, 180
Total*		3, 710	14, 070
Nashville Crossing, (only 3 feet water)		1, 288	2, 777
<i>Lamallee's Chain.</i>			
Reef G, { "Spanish chute"	25	2, 666	2, 666
Reef F, { "Spanish chute"	25	-----	4, 000
Point H	140	-----	830
Reef I, { "Lime-kiln patch"	50	1, 360	2, 250
Reef J, { "Lime-kiln patch"	50	600	600
Point K	100	-----	700
Point L	100	-----	500
Point M	90	-----	680
Point N	90	-----	218
Reefs O, P, Q, { Hole in Wall	50	250	500
Reef R, { Hole in Wall	70	100	333
Reef S	35	200	2, 222
Reef T	55	666	2, 266
Reefs U, V, W	65	-----	9, 425
Reef X	100	-----	370
Reef Y	40	222	222
Reef Z	100	-----	50
Reef A'	100	-----	45
Point B'	100	-----	1, 666
Point D' { Stud-horse chute	60	-----	666
Reef E' { Stud-horse chute	60	1, 923	1, 928
Point F'	69	-----	760
Total		7, 927	32, 897
<i>English Chain.</i>			
Point G'	150	-----	20
Point H' (a single rock)	120	1	1
Reef A'	80	666	666
Reefs B' and C' (Centre patch)	30	888	888
Reef D' (partly removed by Lee)	50	22	22
Reef E' (Brown's patch)	25	2, 666	2, 666
Reef J'	200	-----	132
Reefs F', G', H', and I'	80	-----	17, 770
Total		4, 243	21, 165
<i>Lower Chain.</i>			
Point K' { Montebello Crossing	150	-----	40
Cut N' { Montebello Crossing		868	1, 736
Rock O'	200	-----	1
Reef P'	75	-----	5, 370

* This work is also a part of the shore improvement.

Locality.	Present width of 4-foot channel.	Amount to be removed to make it 100 feet wide.	Amount to be removed to make it 200 feet wide.
Lower Chain—continued.	Feet.	Cubic Yds.	Cubic Yds.
Cut Q" (partly removed by Lee).....		1,333	2,666
Reef S" (Omega patch).....	25	1,000	4,000
Point R".....	25		296
Point T" } foot of Sucker chute.....	{ 30	814	814
Point U" }.....	{ 30		800
Patches V".....	150		555
Point X".....	65	148	866
Reef Y".....	15	650	1,300
Total		4,813	18,444

From the foregoing we obtain the following as the cost of improving the natural channel at the lower rapids :

1. *For channel 100 feet wide and 4 feet deep.*

Upper Chain.....	3,710	cubic yards, at \$10,	\$37,100
Nashville Crossing.....	1,288	do..... do.....	12,880
Lamallee's Chain.....	7,927	do..... do.....	79,270
English Chain.....	4,243	do..... do.....	42,430
Lower Chain.....	4,813	do..... do.....	48,130
Total.....	21,981		219,810

2. *For channel 200 feet wide.*

Upper Chain.....	14,070	cubic yards, at \$10,	\$140,700
Nashville Crossing.....	2,777	do..... do.....	27,770
Lamallee's Chain.....	32,897	do..... do.....	328,970
English Chain.....	21,165	do..... do.....	211,650
Lower Chain.....	18,444	do..... do.....	184,440
Total.....	89,353		893,530

To make the shore channel four feet deep, we must excavate for a width of 100 feet :

From foot of rapids to the Nashville landing, 225, 300 cubic yards, at \$9, \$2,027,700		
Upper Chain.....	3,710	do..... at 10, 37,100
Total.....	229,010	2,064,800

For a width of 200 feet.

From foot of rapids to the Nashville landing, 450, 600 cubic yards, at \$9, \$4,055,400		
Upper Chain.....	14,070	do..... at 10, 140,070
Total.....	464,670	4,195,470

Upper Rapids.

These, beginning at half a mile above the lower end of Rock island, extend 13 miles up the river. The principal reefs are known as Lower Chain, (at foot of rapids,) Rock Island Chain, (two miles from foot,) Duck Creek Chain, ($4\frac{1}{2}$ miles from foot,) Campbell's Chain, ($7\frac{1}{2}$ miles from foot,) St. Louis Chain, (10 miles from foot,) Sycamore Chain, (12 miles from foot,) and Upper Chain.

Unobstructed spaces intervene between these Chains, the greatest being two miles, between Campbell's and St. Louis Chains.

Much of the rock is a very friable limestone, and, when quarried, breaks up in the smallest pieces. A very soft yellow sandstone is also common, and a little slate. Large granite boulders are found in many places.

Owing to the softness of the rocks composing the reefs, they have been much more worn away and dislocated by the ice and currents than at the lower rapids, and do not form as great an obstruction. Small steamboats, drawing $2\frac{1}{2}$ feet water, pass them at the lowest stages, towing their barges. The navigation, however, is attended with great risk, and every year that has low water sees several steam-boats sunk, and others seriously injured.

Duck Creek and Campbell's Chains are particularly dangerous. The current is moderate at both, (about three miles per hour;) but the boat, to avoid the prominent rocks, is required to make such sudden turns as cannot often be performed, especially by stern-wheel boats. These two obstructions claim the earliest attention. Sycamore and Upper Chains should have the next.

Rock Island Chain is a continuous flat reef across the river-bed, with a low-water depth of $2\frac{1}{2}$ feet. To make four feet, a cut through it 600 feet long will be required. The water was raised here about 10 inches, by building the dams connecting the islands with the Illinois shore. The width of the river was thus considerably reduced. In the narrowest part it is but 400 yards wide. The average width of the rapids is about half a mile.

In connecting the stations used in sounding, four miles of the right bank were surveyed, and $14\frac{8}{10}$ miles of the left bank. A line of levels gave the fall from head to foot at lowest water 22 feet; average slope, $1\frac{7}{10}$ foot per mile. The greatest slopes of surface are at Upper, Sycamore, and Rock Island Chains, the current being between four and five miles an hour. The range from low to high water at the head of the rapids is 13 feet, and at the foot 23 feet, making the high-water fall 12 feet, or $1\frac{2}{3}$ foot per mile. The relation between the rise on the Chains, and on the sand-bars above and below these rapids, is not well known.

The chutes behind Campbell's and Fulton's islands are not navigable, and could not be made so as easily as the channel now used. But slight benefit would result from closing them. The only method of improving the upper rapids is to remove the rocks that now obstruct the channel, and close some of the side chutes whose tendency is to produce cross-currents.

The following table shows the amount of rock to be removed to make the present channel four feet deep.

Localities.	Present width.	Amount to be removed to make it 100 feet wide.	Amount to be removed to make it 200 feet wide.
<i>Upper Chain.</i>			
Point A.	130		625
Point B.	150		350
Point C.	175		200
Cut D*		740	1,480
Cut E*		2,220	4,440
Total		2,960	7,095
<i>Sycamore Chain.</i>			
Point A.	100		1,330
Point B.	180		270
Point C.	200		170
Patch D.	75	20	20
Points E and F.	70	33	1,500
Points G and I.	70		1,690
Point J.	70	432	1,330
Point K.		74	700
Point L.	200		90
Points M and O.	150		669
Rock N.	75	1	1
Total		560	7,770
<i>Crab Island.</i>			
Patches A and B.	180		800
Points C and C'.	150		500
Total			1,300
<i>St. Louis Chain.</i>			
Point D.	60		
Patch E, (St. Louis rock).	60	160	155
Point G.	80		160
Point H.	80	115	250
Points I and J.	170		800
			175
Total		275	1,540
<i>Campbell's Chain.</i>			
Point A.	170		123
Point B.	150		10
Rock C.	60	10	57
Rock D.	100		
Rock E.	100		
Rock F.	100	140	140
Cut G, (very difficult to pass).		1,670	8,900
Point H.	80	20	195
Point I.	195		
Patch J.	80	10	10
Patch K.	200		130
Patch L.	80	260	265
Total		2,110	9,380

* These cuts are made near the present channel (70 feet wide) to avoid cross-currents.

Localities.	Present width.	Amount to be removed to make it 100 feet wide.	Amount to be removed to make it 200 feet wide.
	Feet.	Cubic yards. 180	Cubic yards. 180
<i>Winnebago Island.</i>			
Patches A, B, C, D, and E, (lying in channels).....	.....	.....	.....
<i>Duck Creek Chain.</i>			
Patch A.....	200	.....	1
Patch B.....	200	1	1
Cut C, } Dangerous {.....	.....	840	2,500
Rock D, } Dangerous {.....	.....	1	1
Patch E.....	100	113	113
Points F and G.....	25	1,033	1,033
Points H and I.....	200	.....	166
Total.....	.....	1,988	3,815
<i>Rock Island Chain.</i>			
Point A.....	150	.....	200
Cut B.....	.....	3,890	7,775
Point C.....	100	.....	150
Patch D.....	120	.....	10
Patch F.....	150	.....	65
Total.....	.....	3,890	8,200
<i>Lower Chain.</i>			
Points A and B.....	200	.....	4,500
Points C and D.....	70	400	1,230
Rock E.....	200	.....	5
Total.....	.....	400	5,735

From the above we obtain the following as the cost to improve the natural channel at the upper rapids:

For a channel 100 feet wide and 4 feet deep.

Upper Chain.....	2,960	cubic yards, at \$10, \$29,600
Sycamore Chain.....	560	do do do 5,600
St. Louis Chain.....	275	do do do 2,750
Campbell's Chain.....	2,110	do do do 21,100
Winnebago island.....	180	do do do 1,800
Duck Creek Chain.....	1,988	do do do 19,880
Rock Island Chain	3,890	do do do 38,900
Lower Chain	400	do do do 4,000
Total.....	12,362	123,620

For a channel 200 feet wide and 4 feet deep.

Upper Chain	7,095 cubic yards, at \$10,	\$70,950
Sycamore Chain.....	7,770.....do.....do.....	77,700
Crab's island.....	1,300.....do.....do.....	13,000
St. Louis Chain.....	1,540.....do.....do.....	15,400
Campbell's Chain	9,380.....do.....do.....	93,800
Winnebago island.....	180.....do.....do.....	1,800
Duck Creek Chain.....	3,815.....do.....do.....	38,150
Rock Island Chain.....	8,200.....do.....do.....	82,000
Lower Chain	5,735.....do.....do.....	57,350
 Total.....	 45,015	 450,150

CONCLUSION.

The practicability of improving the channel by removing the rocks in the bed of the stream, has been proved beyond question by the result of former operations; and a careful examination of the obstructions themselves is sufficient to convince any one without further demonstration. All the rapids pilots I have heard on the subject, are unanimously of this opinion. No apprehension need be felt, that by enlarging the narrow passes we shall lower the water in the pools above, and cause new obstructions. The effect of a sluice-way two hundred feet wide cannot sensibly affect the pools with the whole river for their supply; and even if so, it can be remedied by depositing the excavated rock in the numerous small chutes. Sharp edges will, in most cases, be avoided at the sides of the channel, as the improvement will be effected by removing narrow ledges that at present divide the channel, and the sides will remain as before. A little care will avoid danger to boats where it has been necessary to cut off a point.

The method pursued by Captain Lee, was to drill holes by means of iron tripods standing in the water, with platforms on them for the workmen, and for guides to the drill. The holes were made about one and three-quarters inch in diameter, through two-thirds of the stratum—it having been found impracticable to remove more than one stratum at a time. The charge of powder used was about half a pound; it was placed in a tin tube, which was then filled with sand. The tube being prepared, was placed in the hole immediately on removing the drill; the tube rose above the water, and was supported by the tripod. The effect of the explosion was merely to “split the rock,” pieces seldom being thrown out of the water.

The blasting was thus effected as rapidly and economically as if on the shore. The great difficulty is in removing the detached pieces. Capt. Lee states that it must keep pace with the blasting, and cannot be done advantageously where the water is more than five feet deep. Men were employed expressly to work in the water, whose duty it was to place the tripods, pry out the rock, and fasten to it. Crane-boats were used to raise the stone and deposite it in scows, and these, by means of a “veering-boat,” (flying-bridge,) were swung to the deep holes, and the material was there deposited.

The crane-boats should be constructed double, with a recess sufficiently large to enable the men to fasten to the stone and raise it be-

tween the boats. If hoisted from the side, there is much labor lost in careening the boat before she attains sufficient bearing to raise the stone.

The estimates I have given may be thought too great; but from careful examination, I am convinced that they are not. It must be considered that the work has to be done at a distance from the shore, in a swift current, and liable to frequent interruptions from boats and rafts, and that after all the preparations have been made, the season may prove unfavorable. Still the value of these improvements far outweighs the expense of making them, as the detriment which the two rapids now occasion to commerce is estimated "between five and six hundred thousand dollars annually." (Mr. O'Sullivan, civil engineer—report on Warsaw and Port Byrne railroad.)

The drawings of the upper rapids, and preliminary report, were furnished Col. Long September 20th, 1853; and of the Lower and English Chains of the lower rapids, October 20th, 1853. The other duties I have been required to perform have occasioned the delay in presenting this.

My instructions from Col. Long directed me to co-operate in the surveys with Mr. J. Barney, U. S. agent for the upper, and Mr. J. G. Floyd, U. S. agent for the lower rapids. I was deprived of this, on the part of the former, by the requirements of his agency at Dubuque, and of the latter by his ill health.

I am, however, indebted to them, as well as to Capt. Leroy Dodge, Capt. Bersie, Capt. Hines, Capt. Hugh White, Capt. Hall, Capt. Waggoner, and other river-men, for their counsel and advice. Capt. Waggoner and Capt. Hall aided me in the surveys.

Very respectfully, sir, your obedient servant,

G. K. WARREN,

Lieut. Topographical Engineers U. S. A.

Brevet Lt. Col. J. E. JOHNSTON,

Corps Topographical Engineers,

Sup't W. R. Improvements, Louisville, Ky.