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D E S I G N O F C O A L S C R E E N O U T F I T

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PREPARATION OF COAL

The factors which led to the present practice of cleaning and sizing coal.

The practice of separating refuse from coal and dividing the valuable portion into various sizes originated in the anthracite regions of Pennsylvania. Here coal, as mined, is naturally dirty. Some of the seams are thin, making it necessary to brush the roof or take up bottom, either of which causes much of the rock material to be mixed with the coal in handling. In many localities the seams are inclined or pitching and this entails the handling of considerable rock with the coal. Further impurities are due to the natural wetness of anthracite mines, the flow of water washing dirt into the coal when shot down.

It was early seen that the product, as it came from the mines, would not be acceptable to the trade, and breakers came into use, whereby the impurities are removed and the coal graded into its several sizes for shipment.

The second coal producing section to undertake the preparation of coal embraced the states of Indiana and Illinois. Here a considerable output came from seams lying under so shallow a cover that percolating waters, charged with earthy matter, seeped through the seams and greatly increased the percent of dirt. To compete with the coals shipped in from more favored localities, a system of preparation was established, in which the coal was graded into lump, egg and nut sizes.

It should be observed that breaking and sizing were virtually forced upon the two sections named, owing to the natural disadvantages in the seams. Sales agencies handling these coals made, as it were, a virtue out of the necessity and were quick to advertise them as specially prepared and furthermore to emphasize at every opportunity, the great bearing which sizing of coal has upon fuel economy.

Trade names were given coals from certain districts, or from certain mines, many of them suggestive of the natural purity of the fuel, or care taken during preparation to make it clean. The publicity given such fuels resulted to their benefit, as the trade came to appreciate more and more those coals which professedly catered to consumers of fine domestic and steam grades.

A survey of the coal fields of Central and Western Pennsylvania, as well as the Fairmont, Kanawha, New River and Pocahontas districts of West Virginia, made in the early years of their history, would show very little preparation and sizing. Much of the coal entered the market as mined, that is, as "run-of-the-mine", and even though heavily charged with fine coal, the high amount of volatile matter as compared with anthracite, permitted it to be readily burned. In the course of time, this fine coal or "slack" was regarded by the trade as objectionable, and at a large number of mines was eliminated at the face by using a tined fork for loading the coal instead of a shovel. The slack remaining was cast aside into the gob or waste and

lost. Where it could be sold - often as low as ten cents per ton - the slack was loaded with the lump coal and separated at the tipple by runing the contents of each car over a bar screen, often crudely improvised. At many mines where coke was made, the slack was used in the ovens.

At first four factors served to stimulate a general improvement over this primitive method; the increasing acceptance by the trade of the statement that prepared sizes of coal are more economically burned; the desire to compete successfully with the well prepared coals from other sections; the rapid growth of the cement industry in this country, requiring large quantities of slack coal for burning clinkers; and and the increasing number of stoker installations using slack. A gradual transition to meet these changing conditions resulted and in due course of time, practically every mine of any importance was provided with a tipple from which coal could be loaded in sizes such as run-of-mine, 1 1/4 inch lump, 3/4 inch lump, nut and slack. Little attention was given to the elimination of refuse for the reason that most seams mined cleanly and the increase of ash due to rock was unimportant.

The long discussed possibilities of foreign business in coal became a reality with the World War and gave rise to the fifth reason for a most careful cleaning and sizing of the output. Along with the natural desire to excel in the quality of fuel, was the knowledge that most of the export business demanded uniform sizing. To these

causes then is due the installation of shaker screens, picking tables, loading booms, etc., whereby the quality of the product can be better maintained.

PREPARATION OF ANTHRACITE COAL

Dependent upon the nature of the seam and quality of coal mined, there are found in anthracite practice three methods of preparation as follows: Dry Preparation, Dry and Wet Preparation and Wet Preparation.

Dry preparation is in use in those fields where the seams approach a horizontal position, permitting a first separation of impurities by hand when shoveling the coal into the mine wagon; where the seam is dry; where the seam is practically free from impurities or where the benches of slate cleave free from the coal; and where the run-of-mine contains generally not over seven or eight per cent of rock or slate, which may be removed by hand picking or by dry mechanical separators. This system has the advantage of low cost in the initial investment, operation and maintenance. Moreover, shipments of dry coal are preferable to the trade on account of the small percentage of impurities and the elimination of the possibility of freezing and the consequent trouble in unloading.

Dry and wet preparation is practiced where the run-of-mine contains a high percentage of impurities, including rock, bone and slate. This may run as high as 55 percent but run-of-mine must contain large lumps of pure coal, which

can be handled as a separate product, using the dry process. The small pieces are sized and cleaned with water to improve their appearance, the impurities being removed by jigging. Breakers designed for both processes retain all the advantages accruing to the dry process but are higher in initial cost and more expensive for operation than either wet or dry equipment.

Wet preparation is adopted where the run-of-mine is high in impurities, such as results when the seams are much inclined and the coal loaded from batteries with no opportunity for a preliminary sorting, or when the coal shows a discoloration as in the case when mined near the outcrop, or where the entire product comes from wet and dirty seams. Such coal must be washed to make it bright in appearance and attractive to the trade. Breakers designed for the wet process permit of no dry shipments and are higher in first cost and also more expensive to operate and maintain than a dry preparation plant.

WET PROCESS

The wet process is found in the southern fields of Pennsylvania where the seams are highly inclined, with the presence of large quantities of rock, often running as high as 40 percent, as the coal comes from the mines. There is very little bony coal, so that the problem in preparation is largely the separation of rock.

M. A. Walker published in the Coal Age a treatise on the preparation of anthracite coal and has described the

methods used in the Panther Creek Valley, from which the following is extracted: In general the preparation plant consists of two distinct buildings,- the head house and the breaker proper. The function of the head house is to remove all the large pieces of rock and as much small rock as possible; also to render the coal of suitable size and condition for the breaker. The head house product is carried into the breaker, as a rule, by conveyors of either the scraper or carrier type. These are often inclined to gain the height at the breaker end and frequently 250 to 300 feet long. All jigging, final sizing and picking of coal is confined to the breaker.

On Blue Print No. 827 is a diagram showing the run of coal in a scheme of preparation typical of this region. It will be noted that the scheme in the head house is in general as follows: A disposition of the mine rock is made, when necessary, at the dump by means of a by-pass gate in the bottom of the dump chute. The coal stream from the dump is passed over a shaker or shakers having a 6" round mesh, and a consequent separation into two streams, one of lump size, the other of mixed steamboat and smaller sizes. Following first the lump coal stream, it is seen to descend to the picking table, which is about 20 feet long and has a pitch of 2 to 2 1/2 inches per foot. Here all the rock is removed and the clean lump coal, which passes off, is broken down in crushers to steamboat size and smaller. Steamboat size is removed by shakers which have a 4 1/2 inch mesh and is subsequently rebroken. All of this stream goes to that

one of the two conveyors which is devoted to clean coal.

The second stream of coal which consists of everything passing through the 6 inch mesh of the platform screens, is led over shakers having a 4 1/2 inch round mesh. The steamboat coal thus made is hand picked, then crushed and taken to the clean coal conveyor. Everything passing through the mesh of the shaker is led directly to what is known as the "dirty" coal conveyor.

There are thus two streams of coal passing up to the head of the breaker; one cleaned, the other not cleaned and both a mixture of broken and all smaller sizes, except when it is desired to ship steamboat size, which is done by omitting to break down that size in the head house. The clean-coal stream is usually sized over two sets of shaking screens and is passed directly to the pockets, with more or less examination in the chutes.

The dirty-coal stream is sized over four sets of shakers, or as a rule, double the number used for the clean coal. Broken sizes from these screens are usually cleaned by spiral pickers or some other mechanical device, supplemented more or less by hand picking. Occasionally it is jigged. Egg, stone, chestnut and pea sizes are usually led directly from the screens to the jigs. It is the practice in some breakers, however, to spiral or otherwise mechanically pick these sizes on the way to the jigs and it depends a great deal on the local conditions whether or not a profitable percentage of pure coal can thus be deflected to the pockets. Buckwheat size is jigged in a number of cases but more often

it passes directly from the screens to the pockets, as do also the rice and barley sizes.

Preparation diagrams, typical of the flow of coal in the dry process and combined dry and wet processes are shown on Blue Prints Nos. 820, 822 and 827.

PREPARATION OF BITUMINOUS COAL.

The preparation of bituminous coal is quite simple compared with that in the anthracite fields. The great bulk of the production comes from seams which lie almost or quite horizontal and furthermore, it is unusual to find interstratification of rock in any such quantity as characterizes the anthracite seams. Partings, or course, are common. Sometimes these may be disposed of by cutting out with machines and throwing the dust into the gob, or the rock may be hand picked by the miner when loading his car, or else sorted out on the tipple as the coal travels along on conveyors. All this is properly dry preparation, water being unnecessary, except where the coal is very dirty, or where it is to be used for such purposes as coking or the manufacture of illuminating gas.

SCREENS.

The sizing of coal is effected by screens having openings between bars longitudinally placed, by woven wire segments, and by openings made by punching circular, oval, square or oblong holes in the plate bottom; any of these arrangements permitting the fine coal to drop through while

the larger pieces pass over the screen.

A few of these screens with dimensions are shown on blue print No. 820.

GRAVITY SCREENS.

When screens are stationary and set at an angle of from 27 to 35 degrees, so that the coal moves over them by gravity they are known as gravity screens.

The gravity screen is the simplest and cheapest. It is, however, open to the objections that only a rough separation is usually made, there is excessive breakage, due to dumping coal in bulk on the screen, and there is no opportunity for an inspection of the product and the removal of impurities. Installations of gravity screens have been made recently where the coal is fed to the screens by a conveyor at such a rate that there is a constant flow of coal over the screens in quantity to insure effective screening. The coal will flow differently depending upon fracture, moisture content and quality. Weather and temperature also affect the flow. Coal will hang on the screens in the morning due to cold or to rust which has collected during the night and in the afternoons it runs too fast over the polished plates.

The size of opening varies with the size of coal desired: 3/4 inch, 1¼ inch, 2 inch, 3 inch, 4 inch or 6 inch lump. Where bar screens are used the larger sizes are obtained by the removal of alternate bars singly or in pairs. The design of the bars are such as to permit the small pieces to fall thru

without clogging the screen.

The standard size of screens as usually found over the bituminous regions is 12 feet long and 6 feet wide over screen surface. The screen consists of six bearing bars and 39 steel screen bars with 1¼" clear space between the bars. Sometimes they are spaced with a 1-3/8" clear space between them.

SCREENING DEVICES.

A difficulty frequently met with in screening coal is that it falls upon the screen in masses instead of spreading out over the entire screening surface. This is especially noticeable with wet coal and seriously affects the proportion of fine that is removed. A very simple devise is used to spread out this mass. This consists of a series of U or V shaped riffles, either on the plate preceding the screens or on the screen itself, the effect of these being to retard and equalize the flow of coal over the entire width of the screen.

In some regions where the water from the mines, which is heavily charged with acids, is used in the process of preparation, corrosion in the screen is very rapid. Not only is this costly, but also the accumulation of rust retards the flow of coal. Various alloys may be used to counteract these evils. These are resistant to acid waters and remain smooth and the materials run over the screens without hindrance.

Monel metal, sometimes used for this purpose, is an alloy of copper and nickel and contains also a small amount of iron and other impurities. It is prepared by smelting the copper-

nickel ores of the Sudbury Canada district. When cast, monel metal has a tensile strength averaging about 80,000 lbs, and when rolled the tensile strength may exceed 100,000 lbs. per square inch. The alloy is also highly elastic, ductile and malleable and is even better than bronze in its resistance to corrosion.

Lip screens are those whose perforations are oblong, the upper part of the slot being narrow with a gradual increase in width toward the bottom. This enlargement prevents the wedging of coal in the slots. The screen is arranged in steps so that the coal in passing down is completely turned over and away from neighboring particles. This prevents the fine from riding over the screen on lumps.

The general practice is to use slots 12" long and to make the distance between the steps the same length as that of the slots.

When used as a slate picker the bars between the perforations are slightly turned or canted. Coal will flow readily over such a screen, but slate which occurs in flat pieces, will turn edgeways and pass thru the screen. The bend or step has the advantage of spreading the coal, this insuring a more complete separation and it also prevents irregular pieces from wedging in the perforations, thus keeping the screen from becoming clogged.

This screen can be readily adapted to suit the various different conditions which arise in the preparation of bituminous coals. In some locatities the coal is very soft and breaks easily. Here the height of the step is reduced and the slot is

ended at the bottom of the bend or riser.

Again, if the coal breaks in large cubical lumps the taper of the slot may be changed to suit, and where the coal is in flat, flabby, chunks and slot is made shorter, leaving a blank between the rows of perforations for the flat pieces to right themselves on, thus preventing flat oversized pieces from passing thru the screen edgeways.

SHAKER SCREENS

To overcome the disadvantages of the gravity type, the shaker screen was introduced. Here the screens are set at a low inclination, from 5 to 15 degrees, the movement of the coal being not so much dedendent upon gravity as upon the forward thrust imparted by the stroke of the scree which is kept in reciprocatory motion by means of the pair of eccentrics or by a single driving rod loaated as near as possible to the central axis. The openings in the screens may be made by the spacings of screen bars, by cuting circular or oval holes in the botcom plate, or by an arrangement of slotted holes a little wider at the lower end, and a slight drop in the screen at the lower end of each row of slots (lip screens). The travel of the coal is very slow, and due to the motion of the screen, the lumps are seperated so that no fine coal is carried over and mixed with the larger sizes.

The principles of screening which should be noted are as follows:-

1. The perforations should be arranged so that each

prepared size will pass through one set of perforations and over another. No coal is properly screened until it has passed over a screen.

2. The shape of the perforations should be chosen with a view to the sizes to be produced and the fracture and other properties of the coal.. Round perforations give the most uniform sizing, oval perforations clear themselves somewhat better, and lip screens clear themselves best of all - in fact, the latter will screen almost anything. Dry coal having rectangular fracture is the easiest screened. Wet coal with conchoidal fracture is the hardest. A little fire clay makes the fine coal very hard to screen, and no screening process will separate the fine when wet, for the fine particles stick to the large sizes. Lip screens cause the least breakage and abrasion and should be used where possible for very soft coal. Round and square perforations act like nutmeg graters.

3. The thickness of the plates for producing fine sizes should be chosen partly with reference to the sizes of perforations. Plates having inch perforations should not be over 1/8" thick. When the plates are too thick the holes will clog.

4. The length of stroke should bear a relation to the size of the largest perforation on the screen. A 6" stroke produces good results with 6" round perforations. For smaller perforations shorter strokes can be employed, while for larger sizes it is better to use oval perforations or lip screens than to increase the length of the stroke.

5. The speed of the shaker should be such as to keep the perforations clear and get the required tonnage over the screen The speed of the cool is a function of the screen speed, length of stroke and inclination, all of which are more or less interdependent. The speed should be sufficient to cause the coal to screen both on the forward and backward strokes. It should seldom be less than 100 R.P.Ms for easy screening or more than 150 R.P.M. for small sizes of wet coal or difficult screenings.

6. The inclination of the screen should, in combination with the speed and length of stroke, allow screening on the forward as well as on the backward stroke and should be such as will produce an average flow of coal at a speed of about 100 feet per minute.

7. The flow of coal to the screen must be properly regulated. Where small cars are used, it is so easy to handle the dump with a screen of moderate proportions that it hardly pays to consider a feeder. For a moderate size car, say 2 or 2½ tons, a self-feeding screen will give good results. By a self feeding screen is meant one with a blank sheet at the top inclined at a small angle, say 6 to 7 degrees, on which the coal is dumped and which spreads the material and causes it to feed into the screen with moderate regularity. Even for this size of car a feeder is desirable and for larger cars it is essential. Roughly speaking, the capacity of a screen is practically doubled by uniform feeding. There is little to choose between types of feeders so far as

uniform feeding is concerned; both the reciprocating and apron types give good results.

8. The thickness of coal on the screen must be limited by splitting it where necessary. Thus if it is desired to screen the 3/4" coal out of mine run, it is necessary to pass the coal over larger perforations, say 2 or 2½ " first, then to re-screen the undersize over 3/4" inch perforations and then mix again. The size of the perforations determines the thickness of the bed of coal that can be effectively screened. Thus, a bed of coal one foot thick can be screened over 6" perforations, when it would be difficult to screen a bed 3 inches deep over ½ inch perforation. The relative proportions of the various sizes contained in the run of mine must be carefully studied in designing a screen and its width and the amount of splitting determined therefrom.

9. The width of the screen must be chosen so as to limit the coal bed to such a thickness as can be effectively screened over the size of perforations employed. The length of the various perforated plates must be chosen so as to give the coal enough travel to screen out all the undersize without causing a needless amount of degradation. There is no fixed rule governing the size of screens, and proper "splitting" of the coal and arrangement of perforations frequently requires some experimenting.

10. A little vertical as well as horizontal motion

of the screen helps to keep the perforations clean. Knockers can also be used where the perforations cannot be kept clean in any other way.

11. All prepared sizes should be rescreened just before delivery to the picking table or loading chute. These degradation screens may be arranged to shake sideways across the flow of the coal or with it in the ordinary manner. In the former case, however, they should be a little steeper than in the latter.

REVOLVING SCREENS.

Revolving screens are usually from 6 to 8 ft. in diameter. The cylindrical type is preferred to the conical and the axis is set at an angle of from 7½ to 10 degrees. The central shaft is supported at the ends by boxes. On the outer ends of the arms of the carrying spider is bolted a ring to which the screen-jacket of woven wire mesh is attached. The coal enters thru a head wheel, with gear teeth cast on the circumference. A pinion engaging with this gear rotates the screen, which motion moves the coal forward from the head wheel to the discharge end.

Formerly the revolving screen was used almost exclusively for sizing anthracite coal, but owing to the fact that in recent years there are several finer sizes of coal prepared than before, and owing to the moisture, fire-clay, and other sticky substances clinging to the coal as it comes from the mine, it is impossible to prepare the finer sizes without water; and, from the fact that the revolving screen is not well adapted to the

application of water, it has quite generally given way to the use of shaking screens which, besides being being well adopted for use with water, also reduces the breakage.

Revolving screens are even less used in the bituminous fields. They are, however, used to some extent for producing small size coal. They make a slightly better looking coal than do the shaker screen for the pieces are more nearly round and uniform, but they cause more breakage of the coal and consume more power.

PICKING TABLES.

When merely close sizing is wanted the coal may be passed directly from the shaker screens to the railroad cars, but as the quality of coal is of equal importance, some means must be provided whereby the impurities may be sorted out. For this purpose picking tables are used. These are endless steel conveyors made up of overlapping plates mounted on roller chains and traveling at the rate of about 40 feet per minute. They carry the coal from the screens to the cars, are from 4 to 5 feet in width and because of their slow motion, enable the men and boys stationed on either side to sort out the pieces of rock or bony coal. Belts are largely used as conveyors for the small sizes of coal where it is possible to run them horizontally or nearly so. The use of the term picking table as applied to traveling belts or conveyors is unfortunately liable to confusion with the term table as applied to the dressing of ores.

Revolving tables have been introduced and are found to be a very successful substitute for the conveyor form. These

are in reality annular rings with a width of about 4 ft. and an extreme diameter of about 20 feet, this allowing sufficient circumference to place boys both at the innter and outer edges. Coal from the screen passes directly to the ring, and after completing almost 360 degrees of travel and having been hand picked, it strikes an obstruction placed obliquely to the path of travel, is swept from the revolving table and passes to the railroad cars.

Thr great advantage of the revolving table over the conveyor lies in the reduced maintenance cost. The conveyor has a large number of parts, such as rollers, links, bushings, etc.,all of which are subject to great wear and need lubrication to reduce frictional resistance. The table on the other hand has a much smaller number of wearing parts. The disadvantage in its use would appear to be that it can not be applied to tipples already constructed.

The width of picking tables should not exceed 5 feet and they should not travel over 100 ft. per. min. This makes it necessary to divide the coal and to use several tables in mines of large capacity. Roughly estimated, a picking table of any type should not be required to handle more than 1000 to 1500 tons in 8 hours.

COMBINATION SCREEN AND PICKING TABLE.

A combination of the two units of screen and picking table is found in those horizontal types where the coal is impelled forward by an oscillating motion either vertical or horizontal, and in the inclined type, such as an ordinary shaking pan placed

at an angle of from 5 to 10 degrees.

In the Marcus type the screen is arranged in decks, the coal passing first to the upper deck where the nut and slack are removed. The slack is removed from the nut on the middle deck and passes to a chute leading to the slack car. The nut passing over the slack screen on the middle deck passes down a sloping plate to the bottom deck and thru a gate to the nut car. All sizes above nut are now picked on the top deck after which the egg coal is removed by the egg screen and delivered into the car on the egg track, while the lump coal passing over the egg screen is lowered by a sloping plate onto the bottom deck and passes out over the end of the screen to be loaded into a car on the lump track.

The horizontal picking table may be controlled by a "marcus" driving head, by eccentrics, or by short pendulum hangers supported ahead of the vertical. The first operates with a slow forward stroke and a quick return stroke. The last by giving the screen a quick vertical drop at the end of the forward stroke. The eccentric drive is used on the balanced screen in some designs. In such cases there are two screens driven from the same shaft but moving in opposite directions, the object being to obtain balance and eliminate vibration.

LOADING BOOMS

With the use of gravity screens, there has always been an excess of breakage in getting the coal from the screens to the cars. To reduce this tendency, baskets were designed which

might be lifted to the edge of the screen, and after receiving one or more dumps of coal, lowered into the car and the coal discharged with a minimum drop. When shaking screens were introduced, it was also necessary to provide a method of lowering the coal from the screens to the cars so excessive breakage would be avoided, and for this purpose loading booms are now used.

Frequently the picking table is combined with the loading boom, as shown in details of this design. Conveying picking tables may be readily hinged as a whole, in which case the pickers work on walks alongside the tables and are raised and lowered with them, or the tables may be hinged at some intermediate point, allowing a horizontal portion for picking, with a movable extension for loading.

BINS

In the operation of coal mines, it is desired to obtain a uniform daily production. This is now generally impossible because of the irregularity with which the railroad cars are delivered to the mines. In most fields the distribution is such that there is an over supply in the early part of the week, an even supply during the middle and a shortage at the end.

This irregularity works a hardship almost unlimited in its effect. The railroad finds its facilities for transportation over-taxed at regular periods and congestion results. At the mines the rush of work, followed by a pause at each week-end is demoralizing to the working force and in every way prejudicial to a low cost of production. Moreover, the railroads place

a penalty on cars remaining unloaded behind the tipple, which results in a reduced allotment to the offending mine.

The remedy for a condition such as this would appear to lie with the railroads, but no relief coming from that source, the operators themselves in many cases have sought a solution. One plan is to provide extra mine wagons, filling these during the lean days of the week end and by dependence on this reserve coal, any excess car supply could then be cared for. A moment's reflection however, reveals the impracticability of this method. Assuming a mine car of two tons capacity it requires 250 of these to store 500 tons of coal, or enough to load 10 railroad cars. Mine cars will now cost nearly $100 per ton storage capacity and this along with the expense of upkeep and deterioration makes their use prohibitive.

The alternative, which is increasing in favor, especially with the larger companies, is to provide storage bins with capacities ranging from 500 to 2000 tons. The bin is usually located adjoining the tipple, running parallel to the tracks and with ports so arranged that the entire contents can be easily transfered from the bin to railroad cars.

Coal is brought from the tipple to the bin by conveyors or elevators and distributed lengthwise by means of a scraper line conveyor. The consolidation coal company of West Virginia has a number of such bins at their mines and tests have shown that 1500 tons of coal per hour can be transferred from the

bins to the cars.

The cost of a bin, figured on capacity, is very much less than its equivalent in mine cars, probably one-fifth as great. The transfer of the coal, being separated from the operation of the tipple, insures that there is no confusion during the busy periods. Bins make it possible to work the mines when cars are not delivered in the morning as anticipated. With such provisions for storage work goes on until such time as the bins are full, the fewer cars of the week-end being loaded altogether from the mine cars.

ROUTE OF COAL IN THIS SCREEN.

The coal is brought from the mines to the tipple in cars of (2) ton capacity. The coal is dumped into the hopper from which it is fed out to its various routes. When straight run of mine is wanted on track No. 3 the shakers are not run but the gate is opened and the coal is fed directly into the chute to car, or run-of-mine can be run over the shakers, having veil plates to cover the perforations and goes to track No. 1. To send the run-of-mine to track No. 2 it is necessary to run the shakers and remove a perforated plate from the upper shaker screen.

The upper shaker has four plates 36"X72" perforated with 1¾" circular holes, giving a screening surface of 84 sq.ft. These plates are stepped in order to turn over the coal, thus removing the maximum amount of dust and slack. This slack or dust going thru the 1¾" screens goes into car on track No. 3 by

opening a gate at the chute entrance or if the gate is closed the slack goes into the lower compartment of the lower shaker, mixes with egg and nut and is rescreened and sent back to track No. 3 by opening a gate in the egg chute, or into cars on track No. 2 by closing this gate.

The egg coal may be run into cars on track No. 2, or by opening the gate in the egg chute, it can be put in cars on track No. 3. The egg can be rescreened in the egg hopper by being run over 1¾" round perforated plates. The slack is then sent to track No. 3 and gives the egg or nut much better screening.

The lump coal is run over the two sets of screen plates each having 2¾" turnovers so that the coal may be turned enough to take out all dust and slack. It is then delivered to the loading boom which carries it into the car. This loading boom is equipped with walkways and is narrow enough so that boys or men may be employed in picking rock and slate out of lump coal. This loading boom carries the coal to within two feet of the car bottom and keeps the breakage much less than if the coal was permitted to fall directly from the lump chute into the cars. The lump may also be run in with the egg and nut by removing the diamond screen bars in the lower shaker. The loading boom is run by a separate motor and the screen can be run independent of it. The boom is provided with counter-weights which permits it to be easily adjusted.

CALCULATIONS

To find the width of screen to screen 2500 tons per 10 hour day over ¾" perforations. With the turnovers and 84 sq. ft. of screening surface the coal may be 9" deep. With the swinging screens the coal will be carried the full length of the throw. The crank has a 12 inch throw and the crank pitmans are connected to rocker arm in way to give screen a throw of 9/23 of 12". Therefore 9/23 X 12 = 4.667" or .39 ft.
The crank makes 100 revs. per min.
Therefore, coal will travel .39 X 100 = 39 ft. per min. Since the coal is 9" thick, there will be ¾ X 39 = 28.5 cu. ft. per min. passing the screen or 28.5 X 50 = 1425 lbs. per min. or (1425 X 60 X 10) ÷ 2000 = 425 tons per foot of width of screen. therefore 2500 ÷ 425 = 6 ft. - width of screen. (5 ft. 11")

The drive pulley is to be direct-connected to a 1200 RPM motor. A belt 8" wide has been found sufficient to drive such screens and it remains to find the diameter of pulleys. Revs. of motor times ratio of pulleys = revolutions of drive pulley. Therefore 1200 R = 100 R = 1/12 or 1200 X 1/12 = 100 or pulleys must be in ratio of 1 to 12 and since 72" pulley is a stock pulley and a 6" dia. pulley on motor gives good belt contact and since 1:12 = 6:76, therefore, a 6" X 9" pulley is used on the motor and a 72" X 9" pulley on the drive shaft.

For the feeder drive, a 1200 RPM motor is much cheaper than a slow speed motor, and a drive from motor with belt

to a countershaft thence to feeder with chain works better than a direct drive from motor to feeder with a belt, and the feeder has been found to work to best advantage at 30 RPM., therefore 1200 R 30 R 1/40. There are obtained stock sprockets No. 103 with 15 and 31 teeth which may be the ratio of the chain drive. Now the ratio of the pulleys times 15/31 times 120 RPM - 30 or R 15/31 X 1200 - 30 or R - (30 X 31) (15 X 1200) - 1/16 app. and since a 5" belt can drive it, and a 4" dia. pulley on motor gives good belt contact, hence, a 4" X 5" pulley is used on the motor and a 65X5" pulley on the countershaft.

Many of the parts in the screen have been designed from observations of screens now in use and from information obtained from screen builders. Many parts are built very much heavier than they need to be for the sake of symmetry of design. It would be almost impossible to calculate the size of hanger rods to hold the screens or the pitman rods to shake them. There are too many variables entering in for accurate determination. At any time an excess load may be thrown on parts of the screen which cannot be foretold and the experience of others must be relied upon to determine these sizes.

The loading boom should run at approximately 50 ft. per min. Sprockets have 6 teeth with a pitch of 9 inches, therefore (6 X 9) 12 - 4.5 ft. per rev. of head shaft. The spur gears shown are made from stock patterns, therefore 50 4.5 - 11.6 revs. for head shaft and 11.6 X 61/15 - 45.2 Revs. of counter shaft

C" and 45.2 X 62/14 - 200 Revs. of jack shaft "B". The motor runs 1200 Revs. R diameter of motor pulley divided by diameter of jack shaft pulley d D Rm R's or - 200 1200 - 1/6 d : D - 1 : 6 or D - 6d. A 6" diameter pulley gives good belt contact with belt 6" wide. Then 6" X 6 - (D - 36" dia. of large pulley.

SPECIFICATIONS FOR SHAKING SCREENS

This shaking screen outfit is to be built by W. J. Savage Company, of Knoxville, Tenn., according to the following specifications. Any variations from the following specifications by one party without the consent of the other will be at the responsibility of the one so doing. These screens to be ready for delivery to the railroad for shipment not later than June 1,1921 unless byconsent of the purchaser. These screens are to be inspected by an authorized agent of the purchaser not later than May 26,1921 and must have his approval before being shipped.

The framework of the tipple house will be constructed by the purchaser and will be built as near as possible according to the drawings.

Hopper. The dump hopper to be made to hold not under 10 tons of coal. The main body to be made of ¼ inch steel plate, to be braced across to prevent any bulging of sides, with 3" X 4" X 3/8" angles. The hopper to have an adjustable door in front to prevent an excess amount of coal from flowing onto screens. 3" X 3" X 5/16" angles to be placed around the top and rest upon timbers. 13/16" inch holes to be made in hopper about 6 inches from top in order to bolt hopper to timbers with ¾ inch

diameter bolts. A track to be fastened to the bottom of the hopper to carry the feeder pan. This track to be so braced as to prevent any wobbling during work. All rivets to be of 5/8 inch diameter unless otherwise specified. All angles to be as shown on drawing number 660. To be made in accordance with drawing number 660 unless changes agreed upon by both parties. All workmanship to be of the first class.

Feeder Pan: The feeder pan to be built of sufficient size to feed the coal as fast as the screens will clean it, this being 2500 tons per 10 hour day at the maximum. The bottom to be so constructed as to prevent warping due to the coal falling or by hydrostatic weight. The front to be provided with fingers extending 18 inches from pan and made of ¾" X 2" wrought iron. Four wheels 8" dia. with 2¼" tread shall be put on pan to run on track on hopper. This feeder pan to be run at approximately 30 forward strokes per minute. All rivets to be ½ inch in dia. and countersunk unless otherwise specified. The feeder pan to be fastened to a 2 inch sq. c.r.s. driving axle with rivets to prevent its loosening. All workmanship to be of the first class. To be made in accordance with drawing number 660.

Upper Screen: The upper screen to have 72 sq. ft. of 1¼ inch round hole screening surface. Each screen plate to be 3 ft. by 6 ft. and to be stepped as shown on dig. no. 659. All bottom and side plates to be ¼ inch steel. To have a swinging gate at top for run-of-mine. This screen to be hung by three swinging

hangers resting upon 2½ inch square C.R.S. shaft. Hangers to be cross braced and built as shown on dig. no. 662. 3" X 4" X 3/8" angles to run the full length of screens and to furnish bearing braces to hanger shafts. The screen to have two decks, the lower to carry the slack coal either to lower shaker or to slack spout. The bottom deck to be cross braced to prevent warping. The bottom deck to have a gate to run the coal into slack spout or to lower shaker. The screen to have sides of two ¼ inch plates for a distance of 15 inches on both sides of slack spout. All rivets to be 5/8 inch in diameter unless otherwise specified. Drive shaft to be made of 2-15/16 inch C.R.S. and bearings to be of heavy type. All workmanship to be first class. To be built as shown on dig. No. 659.

Lower Shaker: The lower shaker to have 36 sq. ft. of screening surface to pass 2 inch coal, and at lower part to have 3 ft. of diamond screen bars spaced 3¾ inches on centers. The sides and bottom to be made of ¼ inch steel plate. The screen to be hung with 3 hangers braced as shown on dig. No. 662. The screen to have two decks, the lower one taking care of the slack, or slack and egg. The screen to have a 2 15/16 inch C.R.S. driving shaft with two heavy type bearings. The lower end of shaker to be so constructed as to deliver the coal onto loading boom with a fall of not over 3 inches. The screen to have a hopper with

a rescreen for the slack, a curved spout carrying egg coal to track No. 2, and a slack spout carrying slack to track No. 3. The hopper to have a gate to run all the coal in hopper thru curved chute with none going onto slack spout. These spouts to be braced to keep them rigid with screens 3" X 4" X 5/16" angles run full length of screen to reinforce the sides. All rivets to be 5/8 inches in diameter unless otherwise specified. The screen to be built according to drawing number 658. The workmanship to be first class.

Loading Boom: The loading boom to be 32 ft. center of drive sprocket to center of head sprocket. The flights to be made of 3/16 in. steel sheets. The boom to be 5 ft. wide. 8ft. of the boom at the drive end to be made rigid to rest under lower end of shaker screen and 24 ft. to be movable on hinged pins in order to lower head end into cars. This boom to run at approximately 50 ft. per min. and to have walkways along side upon which a man can stand and pick the coal. The boom to be rigidly braced with $2\frac{1}{2}$" X $2\frac{1}{2}$" angles to prevent any buckling. The head shaft to run in two take-up boxes in order that slack may be taken out of the flights at any time. The head end to be provided with a bail to which the ropes on counter weights will be fastened. The boom to be raised and lowered by a 2 ton Yale and Towne electric hoist. The pin hinges to be made sufficiently rigid to eliminate any tendency toward twisting boom. A plate and angle construction must be placed along top covering the flights in such a way

that the man picking will not accidentally get his hand caught in links. No guards are to be placed on shaker side of rigid part but on opposite side must be placed a 3/16 inch plate extending 13 inches above other guard to prevent coal from crossing over boom when coming off the lower shaker at a rapid rate. The links on flights will be built up type with 2¾ inch dia. wheels rolling on pipes with brass bushings. Flights will be 9 inch pitch. All rivets to be 5/8" in dia. unless otherwise specified. Boom to be made in accordance with drawings number 666 and 667. The workmanship to be first class.

Transmission: The loading boom to be run by a 5 HP General Electric Co. - Altering Current motor - 3 phase - 60 - cycle - 220 volt at constant speed of 1200 R.P.M. All motors and starting boxes to be supplied by purchaser.

The shaking screen to be run by a 20 HP GE - A.C. motor - 3 Phase - 60 cycle - 220 volt at constant speed of 1200 R.P.M. This motor to be belted to a countershaft with a speed reduction great enough to run the shakers at approximately 100 R.P.M.

The feeder pan to be run by a 3 HP - G.E. - A.C. motor - 3 Phase - 60 cycle - 220 volt at a constant speed of 1200 R.P.M. To be run to countershaft with a sprocket and pulley reduction large enough to run the feeder at approximately 30 R.P.M. Starting boxes to be supplied with all motors. The belting to be furnished by screen builders.

The shaker pitmans to be made of straight grained white oak timber, seasoned and to be reinforced by 5/8 in X 3 in. W.I. bars running their full length, both top and bottom, and bolted together with ¾ in. dia. bolts. The shakers to receive their motion from a heavy rocker arm which is itself oscillated by a rotating crank and pitmans. These, rocker arm shaft and crank shaft, to have bearings sufficiently large to avoid any great vibration.

REFERENCE DRAWINGS.

DESCRIPTION	DWG.	DATE
General Plan of Tipple	No. 657	7-10-20
Details of lower shaker screen	" 658	7-12-20
" " upper " "	" 659	7-12-20
" " hopper & feeder	" 660	7-13-20
" " flights & links	" 661	7-20-20
Miscellaneous details	" 662	7-14-20
Loading boom flight die	" 665	7-20-20
24 ft. ctr. boom	" 666	7-23-20
8 " " " (rigid part)	" 667	7-26-2-
Tipple house elevations	" 698	1-30-21
Miscellaneous screen details	" 699	1-3-21

S I G N E D ----------

BILL OF MATERIAL

Shaking Screen Plant -

Shop No. 300

LOADING BOOM

No. of parts.	Description	Make	Dwg. No.	Marked
1	Male Die for flights	C.I	665	652 -B
1	Female " " "	C.I	665	652-A
1	Head shaft 2 15/16" dia. X 7 3 1/8	C.R.S.	667	667 -F
1	Foot " 2 3/16" dia. X 6 8¼"	"	667	666-A
2	6T - #279½ sprockets X 2 15/16" bore	M.I	667	
2	6 T- " " X 2 3/16" "	M.I.	667	
1	61T-1¼"P-4½"F-2 15/16" bore spur gear	C.I.	667	
1	Jack shaft 2 3/16" dia. X 5 4¾"	C.I.S.	667	667-B
1	Counter " 2 3/16" dia X 24½"	"	667	667-C
1	6" X 24" C.F. Pulley	C.I.	667	
1	62T-1"P-3"F-2 3/16" bore spur gear	C.I.	667	
1	15T-1¼"P-3"F-2 3/16" bore pinion	C.I.	667	
2	center hinges	C.I.	660	690-B
2	Outside "	C.I.	660	690-C
4	2 3/16" Standard Bearings with Bolts	C.I.	667	
2	2 15/16" " " " "	C.I.	667	
36	¾ " dia. X 16" bolts	W.I.	667	
6	¼" X 8" X 24" plates (Rests)	St.	667	
4	5/16"X3½"X3½" angles X 7 1/6"	"	667	
6	¼"X12"X24" plates (Braces)	"	667	

Shop No. 300

No.of parts Rgd.	Description	Make	Dwg. No.	Marked
8	¼"X2½"X2½" angles X24"	St.	667	
2	2"X2"X¼ angles X 6 1"	"	667	
4	2"X2"X¼" angles X 3 0"	"	667	
2	3"X4"X¼" angles X 10 "	"	667	
1	2½X2½X¼" angles X 8 1/6"	"	667	
2	3"X3"X½" angles X 8 "	"	667	
3	2"X2"X¼" angles X6"	"	667	
1	3/16"X18"X 8 " plate	"	667	
	Gussit Plates	"	667	
40	Lbs. 5/8" rivets	"	667	
2	Filler Bars 1" X1 8½"	"	667	666-C
1	Bail	"	666	
2	2 3/16" Std. Takeups	C.I.	660	666-B
2	Head Plates ½"X36"X36"	St.	666	
4	Brace Plates ¼"X24"X24"	"	666	
12	2½"X2½"X¼" angles X 2 9" braces	"	666	
2	3"X4"X¼" angles X2 0" (Takeup Bases)	"	666	
4	3½X3½X5/16" angles X22 0" tracks	"	666	
12	2½"X2½"X¼" angles X 81/3" Cross Braces	"	666	
5	2½"X2½"X¼" angles X 5 9" Diagonals	"	666	
10	2½X2½X¼" angles X 2 6" "	"	666	
10	2½X2½X¼" angles X4 6" Side Braces	"	666	
28	1"X1½"X12" White Oak Strips	W.O.	666	
2	1½"X12"X22 0' " " walks	W.O.	666	

Shop No. 300

No. of parts Rgd.	Description	Make	Dwg. No.	Marked
6	2"X2"X¼" angles X6" Guard clips	St.	666	
2	3/16"X 9"X22 0" Guard Plates	"	666	
100	Flights 9"P-3/16" Pl.X5 0"	"	665	
200	Rollers and Pints	C.1	640	
2	CRs Pins 1 15/16" dia. X 7"	CRs	660	690-C
200	2"X2"X¼" angles X6" clips on Flights	St.	665	

Shop No. 301: Hopper

No. Rgd.	Description	Make	Dwg. No.	Marked
2	3/16" side plates	St.	660	
1	¼" Frong "	"	660	
1	¼" Back "	"	660	
2	3"X3"X5/16" angles X12 1/3" on side	"	660	
2	3"X4"X3/8" angles Braces inside	"	660	
	2½X2½X¼ angles Frame work	"	660	
2	3"X3¼"X5/16"angles X9 1/5" Front and/ rear	"	660	
40	¾"X10" Botts with nuts	W.I.	660	
2	6"X4"X½" angles C 4 9" track	St.	660	
4	3"X3"X¼" angles X 4 0" Braces	"	660	
4	¼"X6"X18" ft. Plates Gussits	"	660	
1	¼"X12"X3 " door	"	660	
2	½"X2½"X5 " straps	W.I	660	
15	5/8" Rivets	St.	660	

Shop No. 302 : Feeder Pan

3	6"X4"X3/8" angles X4 1/3"	St.	660	
1	3/8" X 3 9"X4 3" Bottom Plate	"	660	
7	3/4"X2"X27" Fingers	W.I.	660	
5	5/8" Rivets	St.	660	
2	2½"X2½"X1/4" angles X3-3" Brace Angles	"	660	
4	8"dia-1 15/16" B- Tr. 2¼"-3" Hub. Wheels	C.I.	662	
2	2" square bars, with washers, nuts cotters for wheel axles	C.R.S.	662	

Shop No. 302:Feeder Pan.

No. Rgd.	Description	Make	Dwg. No.	Marked
1	2" square bar with washers, nuts, cotters etc. for driving axle	CRS	662	

Shop No. 303: Lower Screen

1	2 15/16"X8 1/6" Drive Shaft	DRS	658	657-H-4
62	No. 1 Diamond screen Bars 3/16"	St.	658	
3	2½"Sq.X 7 6" Hanger shafts	CRS	658	
2	¼"X36"X72"-2" perforated plates	St.	658	
2	¼"X48"X72" plates bottom	"	658	
1	¼"X24"X72" " "	"	658	
1	¼"X34"X72" " "	"	658	
1	5/8"X4"X6 6" screen bar support	"	658	
6	½"X3"X10" hanger shaft clamps	"	658	
4	¼"X24"X10 "side plates	"	658	
1	¼"X12"X5 0" " "	"	658	
2	2"X2"X¼" angles X 20 0" top side angles	"	658	
2	3"X4"X5/16" angles X 20 0" screen "	"	658	
2	3"X3"X¼"angles X 20 0" " "	"	658	
2	3"X3"X¼" angles X 6 0" screen bar supports	"	658	
1	5/8"X6"X6 6" bar backing	W.I.	658	
2	3"X3"X5/16" chute angles	St.	658	
2	Bearings	C.I.	699	657-H-4
	Bottom Plate in chute	St.	658	
1	egg chute	"	658	

Shop No. 303: Lower Screen.

No. Rgw.	Description.	Make	Dwg. No.	Mark
1	slack chute	St.	658	
1	Hopper and rescreening outfit	"	658	
	Gussit Plates	"	658	
30	Lbs. 5/8" Rivets	W.I.	658	
3	Sets Hanger System complete		662	

Shop No. 304: Upper Screen

1	2 15/16"X 7 6" drive shaft	CRS	659	
3	2½"Sq.X7 6" hanger shafts	"	659	
4	¼"X36"X72" perforated plates	St.	659	
1	¼"X48"X72" bottom plate	"	659	
1	¼"X24"X72" " "	"	659	
1	¼"X12X72" " "	"	659	
1	¼"X36"X72" hinged door	"	659	
	1½"X1½X¼" angles X 6-0" Pl. supports	"	659	
	2"X3"X¼" angles X 3 0" -2½" step	"	659	
2	sides as shown	"	659	
1	Bottom Plate ¼"X72" braced	"	659	
1	12" hinged gate as shown	"	659	
6	½"X3"X10" hanger shaft clamps	WI	659	
3	Sets hanger system complete		662	
	Gussit plates ¼"	St.	659	
	Angle Braces	"	659	
2	¼"X24"X48" reinforcing plates	"	659	

Shop No. 304: Upper screen.

No. Rgd.	Description	Make	Dwg. No.	Mark
1	chute as shown	St	659	
30	5/8" rivets	W.I.	659	

Shop No. 305: Pitmans cranks.

2	Feeder Pitman Rods	W.I.	662	
2	Drive Pitmans complete 11 6"C.to C.		699	657-K-1
2	" " " 15 0" " " "		699	657-K-2
2	Feeder Pitman arms complete	C.I.	662	
2	Cranks Drive Pitmans Complete		699	657-K-3
2	Drive cranks	C.I.	699	657-H-2
2	Rocker Arms All to be with oil cups, etc.	C.I.	699	657-H-1

Shop No. 306: General Transmission:

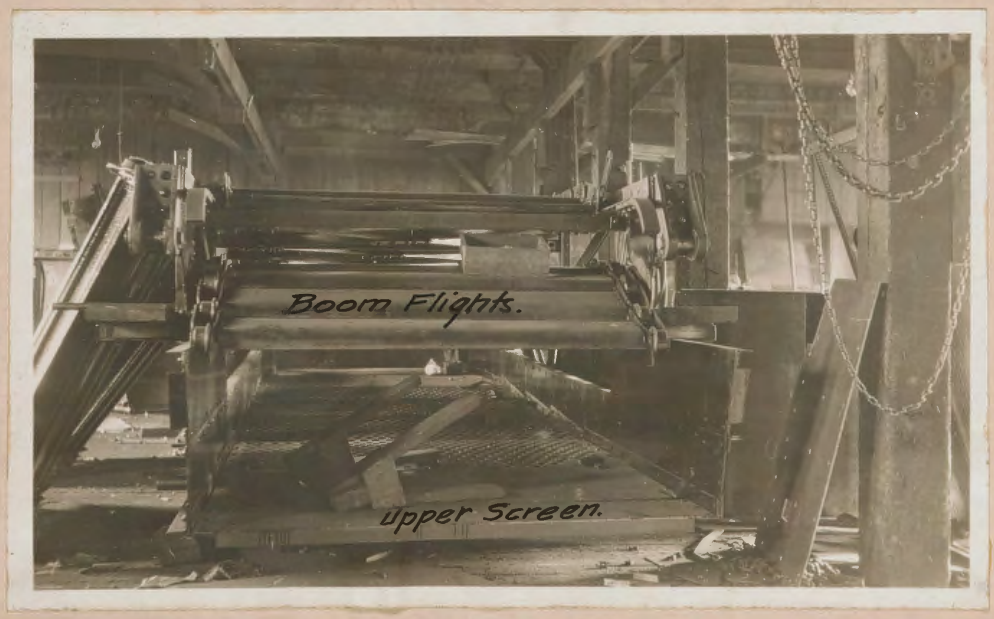
1	20HP-1200 Revs.-220 volt-3 Phase			
	60 cycle-A.C.-W.H.-Motor.Pulley 6"X8"		657	
1	3HP-1200 Revs.-220 volt-3 phase-60 cycle			
	AC-WH-Motor. pulley 4"X5"		657	
1	65"X5"X2 7/16" Bore C.I. pulley	C.I.	657	
1	72"X8"X4 7/16" Bore C.I. pulley	"	657	
40	ft. 8" condor" leather belt		657	
30	" 5" " " "		657	
1	15T-#103 sprocket 2 7/16" bore	C.I.	657	
1	31T-#103 " 2 7/16" "	"	657	
1	2 7/16"X3 11" feeder drive shaft	CRS	662	
1	2 7/16" X 8 0" " counter "	"	657	

Shop No. 306: General Transmission.

No. Rgd.	Description.	Make	Dwg. No.	Marked
4	2 7/16" set collars	C.I.	657	
2	4 7/16" " "	"	657	
1	4 7/16" X 7 1½" drive shaft	Crs	699	657-N-1
2	4 7/16" Standard bearings	C.I.	657	-
4	12" sheaves for boom			
1	5 HP - 950 Revs. - 220 volt- 3 phase 60 cycle AC-WH-Motor for boom			
100 ft.	5/8" wire rope for ctr. wts	St.	657	



Lower Screen.



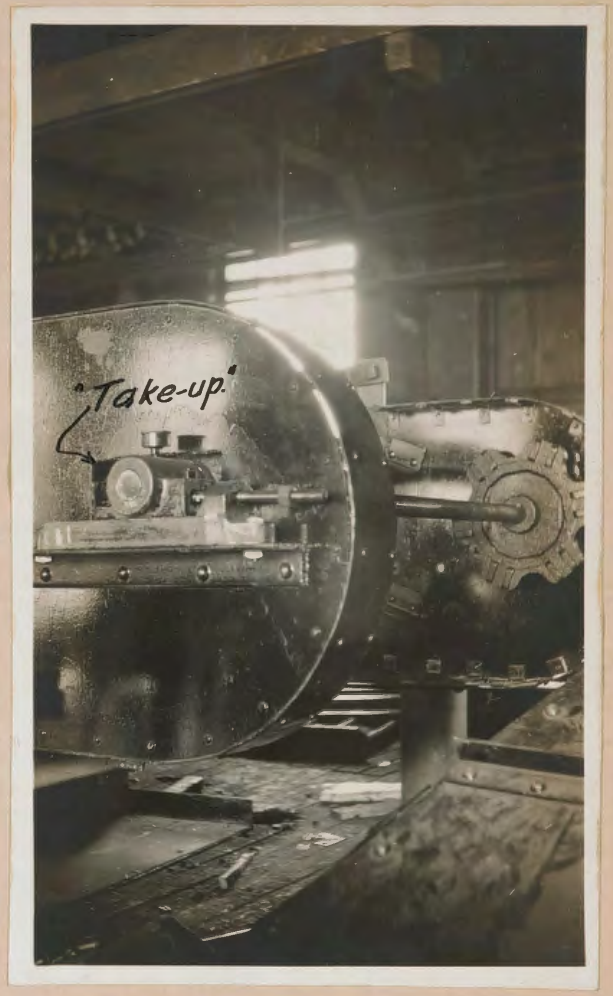
Loading Boom and Upper Screen.



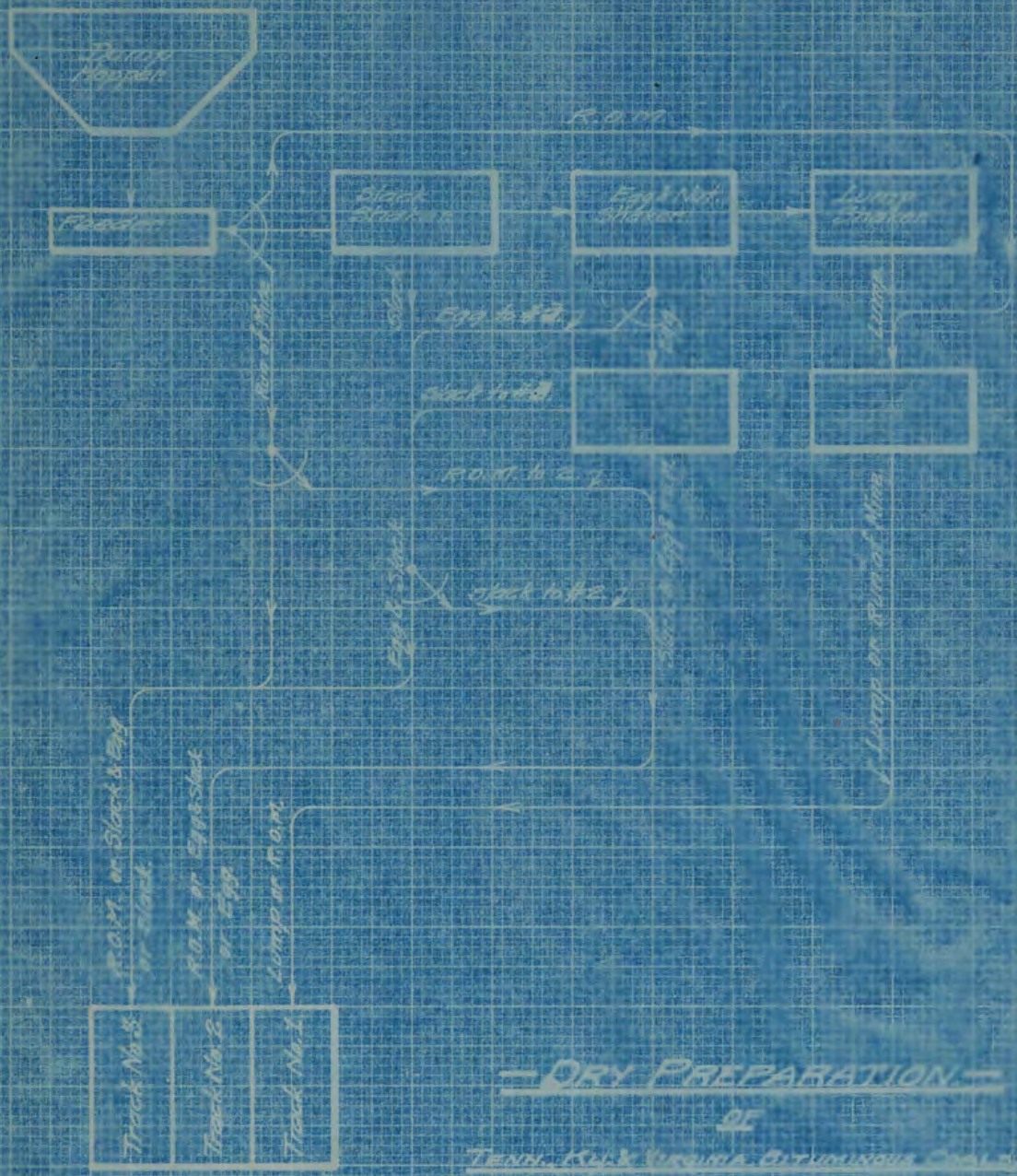
Drive End of Loading Boom.



Side View of Loading Boom.

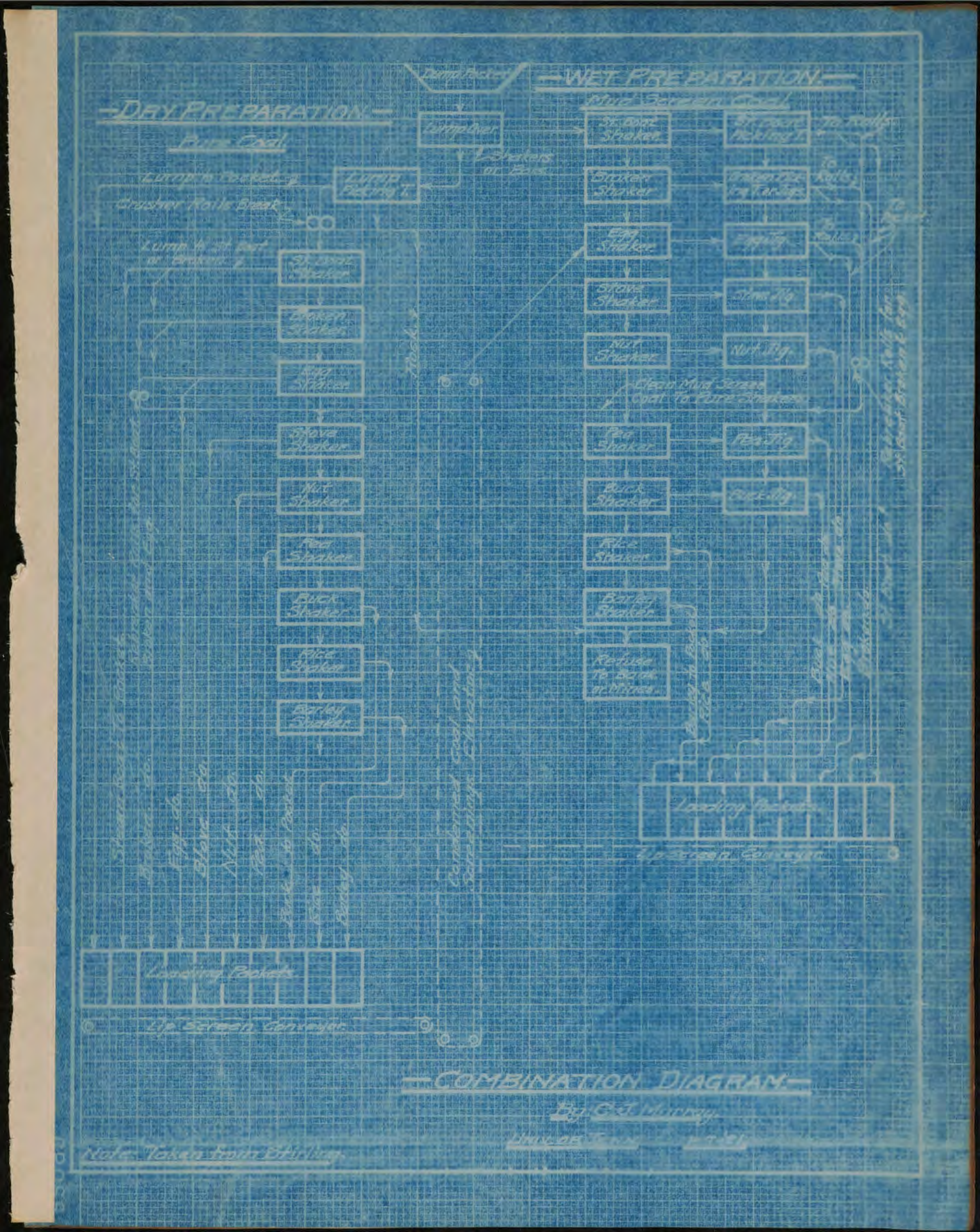


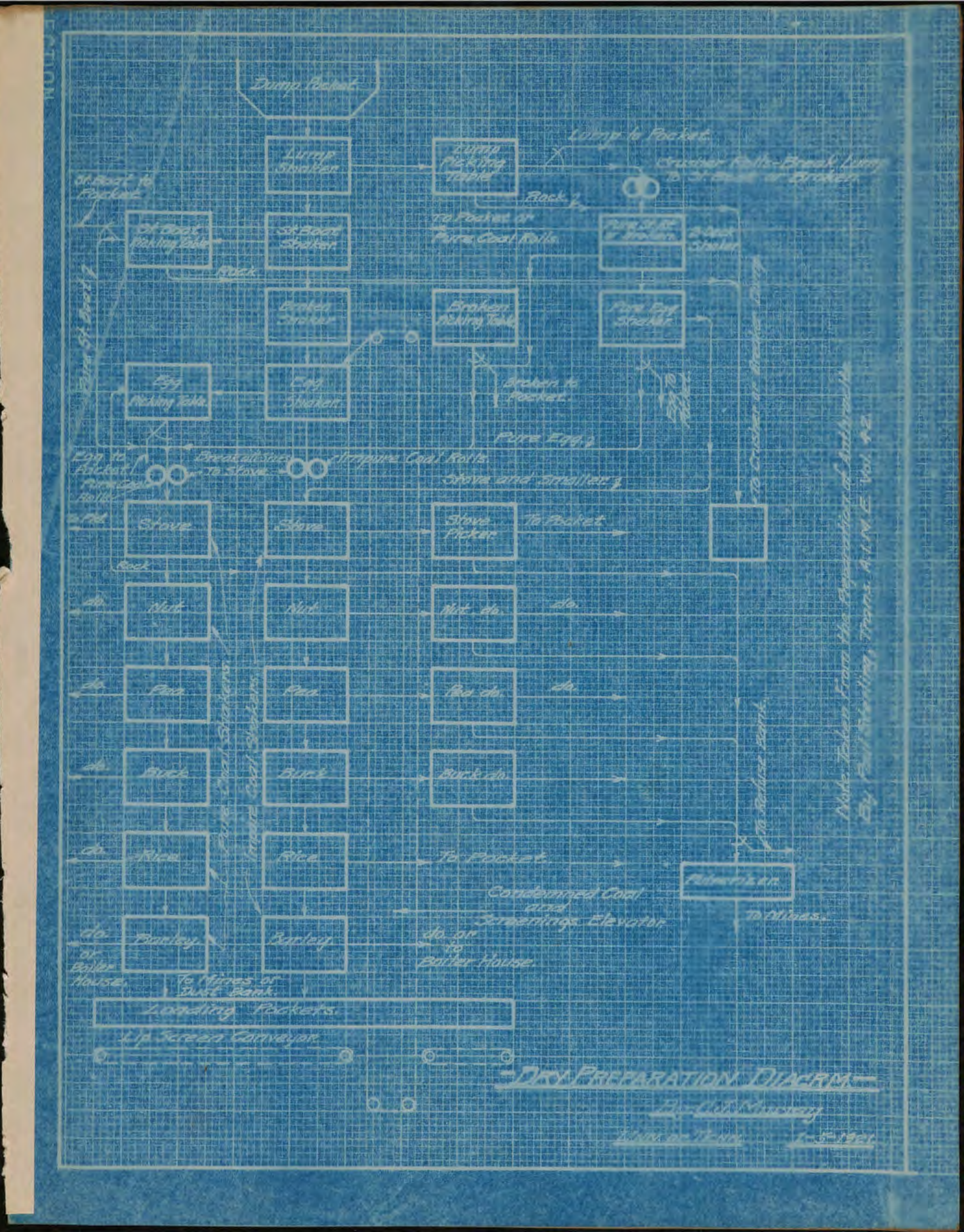
Head End
of Loading Boom.

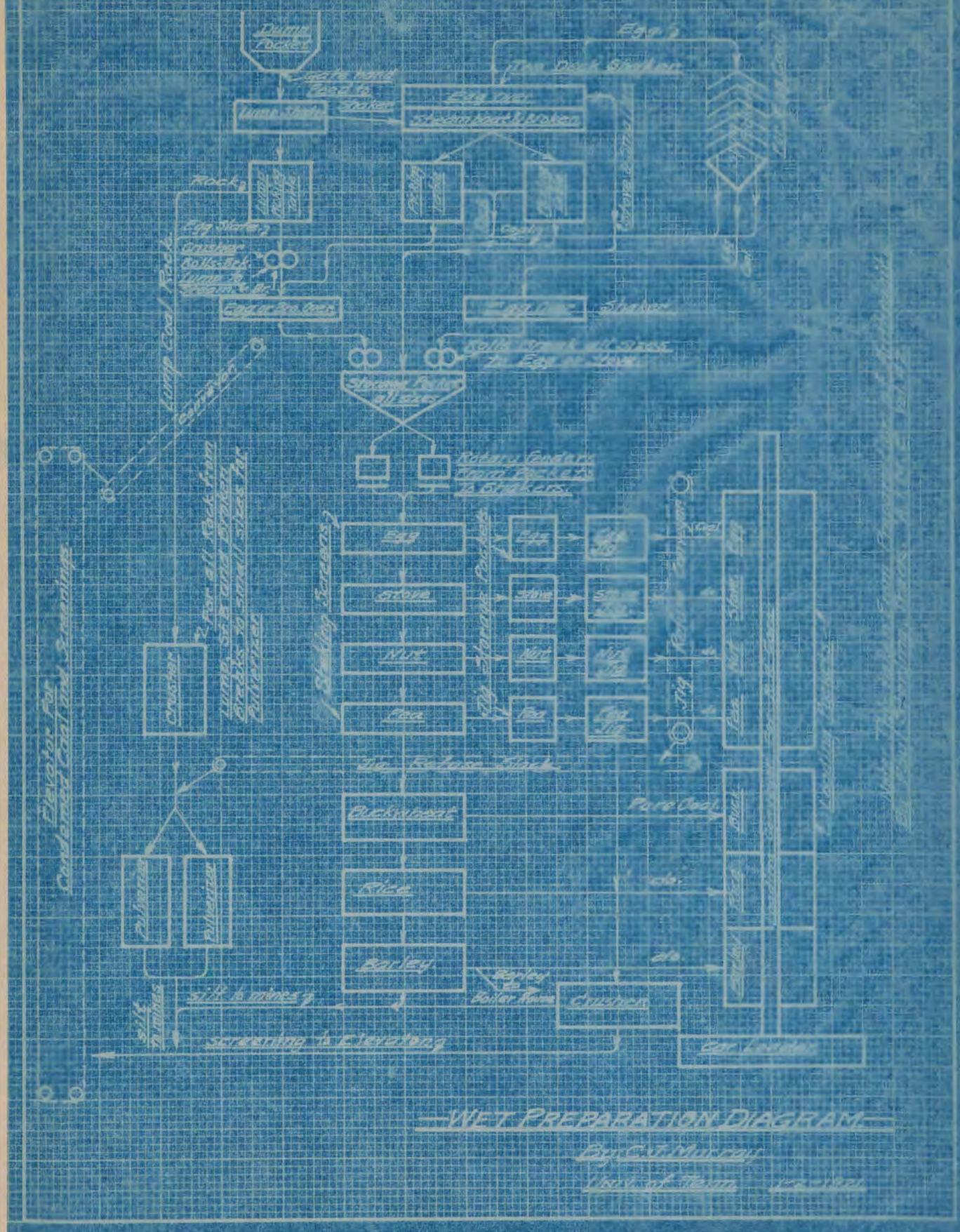


—DRY PREPARATION—

OF


Dry Preparation
Wet Preparation
Combination Diagram


Dump Pocket
Lump Screen
Lump Picking Table
Lump to Pocket
Back
To Pocket or Pure Coal Rolls
Pea Coal Picking Table
Pea Coal Screen
Egg Picking Table
Egg Screen
Egg to Pocket
Pure Egg
Broken to Stove
Impure Coal Rolls
Stove and Smaller
Stove
Stove Picker
To Pocket
Nut
Nut do.
do.
Pea
Pea do.
Buck
Buck do.
Rice
Rice do.
To Pocket
Condemned Coal and Screenings Elevator
Elevator
To Mines
Barley
Barley do.
To Boiler House
To Mines or Dust Bank
Loading Pockets
Up Screen Conveyor
SECTION



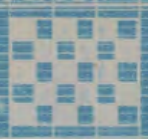
WET PREPARATION DIAGRAM

Round Hole Screen Plate.



Size of Perforations.	Between Centers.
1/8"	1/16", 1/4"
1/4"	3/16", 7/16"
3/8"	2/16, 3/8, 11/16"
1/2"	11/16, 7/8, 1"
5/8"	15/16, 1 1/16", 1 1/4", 1 1/2"
1"	1 1/4", 1 1/2"
1 1/4"	1 5/8"
1 1/2"	1 7/8", 2 1/8"
1 3/4"	Only Centers.
2"	"
2 1/4"	"
2 1/2"	3"
2 3/4"	Only Centers.
3"	3 3/4"
3 1/4"	3 1/2", 4"
3 1/2"	3 3/4", 4 1/4"
4"	4 1/2", 5"
4 1/4"	4 7/8", 5"
4 1/2"	4 7/8", 5"
4 3/4"	5", 5 1/4"
5"	5 1/2", 5 13/16"
5 1/2"	6 1/8"
6"	6 1/2", 7 1/4"
7"	7 7/8", 8 1/2"

Square hole Screen Plate.



Size of Perforat.	Between Ctrs.
1/8"	7/32"
1/4"	3/8"
3/8"	9/16"
1/2"	11/16"
5/8"	15/16"
1"	1 1/4"
1 1/4"	1 9/16"
1 1/2"	1 7/8"
1 3/4"	2 1/8"
2"	2 3/8"
2 1/4"	Only Centers.
2 1/2"	" "
2 3/4"	" "
3"	" "
3 1/4"	" "
4"	" "
5"	" "

End Staggered Slot Screens.

Width of Slot	Length of Slot.
1/8"	1/4", 1/2", 3/4", 1 1/2"
1/4"	1/2", 7/16, 3/4", 1", 1 1/2", 2 1/2", 4"
3/8"	1/2", 3/4", 1", 1 1/2", 1 3/4"
1/2"	3/4", 1", 1 1/4", 1 1/2", 2"
3/4"	1", 1 1/4", 1 1/2", 4"
1"	1 1/2", 1 3/4", 2"
1 1/4"	2", 2 1/4", 2 1/2"
1 1/2"	2 1/2", 2 3/4", 3"
1 3/4"	2 1/2", 3"
2"	3", 4"
2 1/2"	4 1/2"
3 1/2"	5"



Note: From Mining Catalog.

C. J. Mullroy
Univ. of Tenn. 2-3-1921

STANDARD SIZES DIAGONAL SLOT SCREENS.

Length of Slot	Width of Slot.
$\frac{1}{2}$"	14 Mesh - .048.
$\frac{1}{2}$"	$\frac{1}{16}$"
$\frac{1}{2}$"	$\frac{1}{20}$"
$\frac{1}{2}$"	$\frac{3}{32}$"



Coal Grading.

Kind of Coal.	Passes Thru.	Passes Over
Lump Coal	———	$5\frac{1}{2}$"
Steamboat.	$5\frac{1}{2}$	$4\frac{1}{2}$"
Egg.	$4\frac{1}{2}$"	$3\frac{1}{4}$"
Broken.	$3\frac{1}{4}$"	$2\frac{1}{4}$"
Stove	$2\frac{1}{4}$"	$1\frac{1}{2}$"
Chestnut.	$1\frac{1}{2}$"	$\frac{7}{8}$"
Pea	$\frac{7}{8}$"	$\frac{9}{16}$"
Buck No. 1 or Buckwheat.	$\frac{9}{16}$"	$\frac{5}{16}$"
" " 2 " Rice.	$\frac{5}{16}$"	$\frac{3}{16}$"
" " 3 " Barley.	$\frac{3}{16}$"	$\frac{3}{32}$"
" " 4 " Birdseye.	$\frac{3}{32}$"	$\frac{1}{16}$"
Culm or Slush.	$\frac{1}{16}$"	

NOTES ON BELTS.

Belt Width	Speed	Lump Sizes.
12"	300 ft/m.	2"
16"	350 "	3"
18"	400 "	4"
24"	450 "	8"
30"	525 "	14"
36"	600 "	18"

Flexibility.	
Width Belt	Ply Recom.
12" & 14"	3 or 4 Ply.
16", 18", 20"	4 or 5 "
22", 24, 26	5 " 6 "
28", 30"	5, 6, or 7 Ply.
32", 34, 36.	6, 7 or 8 "
42", 48"	7, 8 " 9 "
54", 60"	8 or 9 Ply.

Tension Should Not exceed 24# per inch per Ply. Inclination Should be about 20° to horizontal.

From Nitney Catalog.

Capacity: At 300' per min. Mat. Wt. 50# Cu. ft. In tons per hr. is app. Sq. of $\frac{1}{2}$ of width. A 36" belt will handle a ton of coal per hour per $\frac{1}{10}$ of Speed per min.

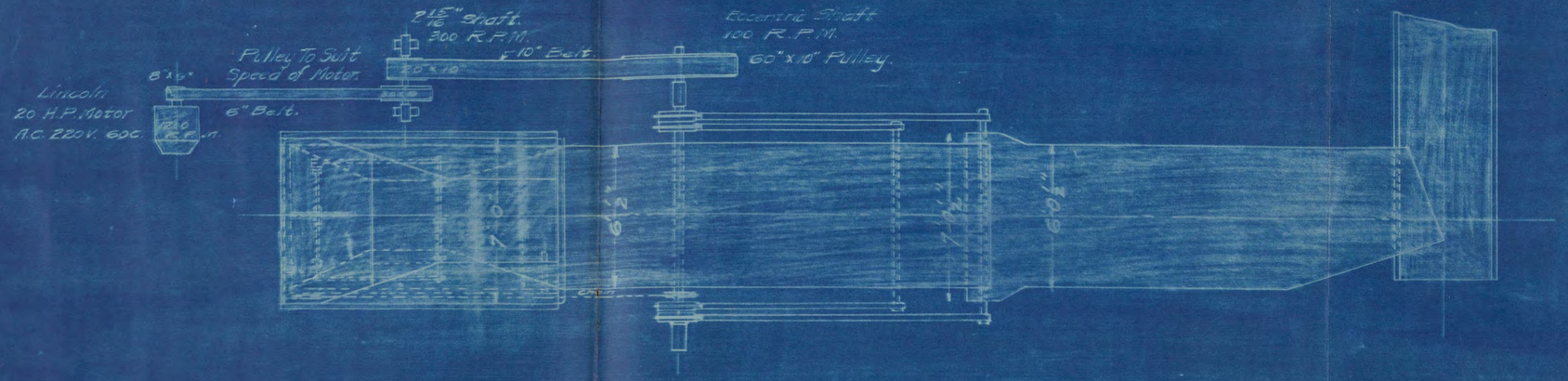
C. J. Murray
Univ. of Tenn.
2-3-1921.

Road & Type of Car	ft. A	in	ft. B	in	ft. C	in	ft. D	in	ft. E	in	ft. I	in	Capacity Cu. Ft.	Capacity Lbs.
Pennsylvania: Box.	36'	4"	9'	10 1/4"	11'	8"	12'	4 5/8"	13'	0 3/8"	3'	6"	1981	60000
" Gondola, Bottom Hopper.	33'	0"	10'	1 1/2"			3'	6"	10'	7 1/4"			1672	100000
" Flat.	40'	2"	9'	3"			3'	10 1/8"	6'	7 1/8"			371	100000
" Gondola Long.	52'	0"	9'	10 3/4"			3'	4 3/4"	7'	3 1/8"			1452	140000
New Y. Central; Refrigerator.	37'	5"	9'	6"	12'	1"	12'	0"	10'	0"			1707	50000
Lehigh Valley: Gondola, Wood.	35'	9 1/2"			5'	0"			6'	8"			227	40000
" " Cinder.	36'	0"			7'	11"			6'	6 1/2"			1273	80000
Erie: Box.	34'	6 3/8"	9'	3 1/4"	11'	7 3/8"	12'	7"	13'	3 1/2"	3'	4"	1927	60000
D., L. & W.; Hopper.	30'	9"	10'	1"	10'	0 1/2"			10'	8"			1680	100000
Cent. R.R. of N.J.; Box.	34'	10"	9'	7"	11'	7"	12'	5"	12'	10"			1994	60000
B. & O.; Furniture.	40'	6"	9'	6 1/4"	12'	3 1/8"	13'	0 1/4"	13'	9 7/8"	3'	1"	2321	50000
Ferre Marquette; Box.	40'	0"	9'	11"	12'	0"	12'	3"	13'	0"			2562	50000
Rock Island; Gondola, Steel.	38'	0"	10'	1"					8'	8"				100000
Great Northern; Hay.	33'	0"	9'	2"	12'	0"	12'	9 1/2"	12'	10 1/2"	3'	3"	1983	40000
Northern Pacific; Lumber.	41'	0 3/8"	9'	8 1/2"			13'	3 3/8"	14'	0 1/8"			2990	80000
Southern Pacific; Box.	41'	10"	10'	0"	13'	3"	14'	2"	14'	7 3/8"			3370	100000
Atchi. Top. & S. Fe.; Coal & Coke.	34'	0"	9'	10"	12'	2 1/2"	11'	10"	15'	3"				44000
Mo. Kan. & Tex. Refrigerator.	42'	4 1/2"	9'	9 1/2"	12'	1 3/8"	12'	10 1/2"	14'	0"			1972	60000
Norfolk & Western; Box.	36'	1"	9'	6 1/2"	11'	5"	12'	4"	13'	3 1/2"			1896	50000
" " Coke, Steel.	42'	10"	10'	0"	13'	6"			13'	6"			3458	100000
Merchant Dispatch; Refrigerator.	36'	2"	9'	9"	12'	3"	13'	1"	14'	1 1/2"	3'	6"	1829	60000
Canadian Pacific; Horse.	47'	1 1/2"	9'	9"	12'	3"	13'	3 1/2"	13'	3 1/2"			2036	24000
N.Y. & N.H. & Hartford; Auto.	38'	6"	9'	7"	12'	7"	13'	2"	13'	10"			2448	80000
Boston Maine; Grain.	36'	10"	9'	7"	12'	0"	13'	4"	14'	0"			2460	60000
Max. Dim. taken from Dif. Cars.	61'	0"	10'	7"	14'	11"	15'	7"	15'	7"				110000

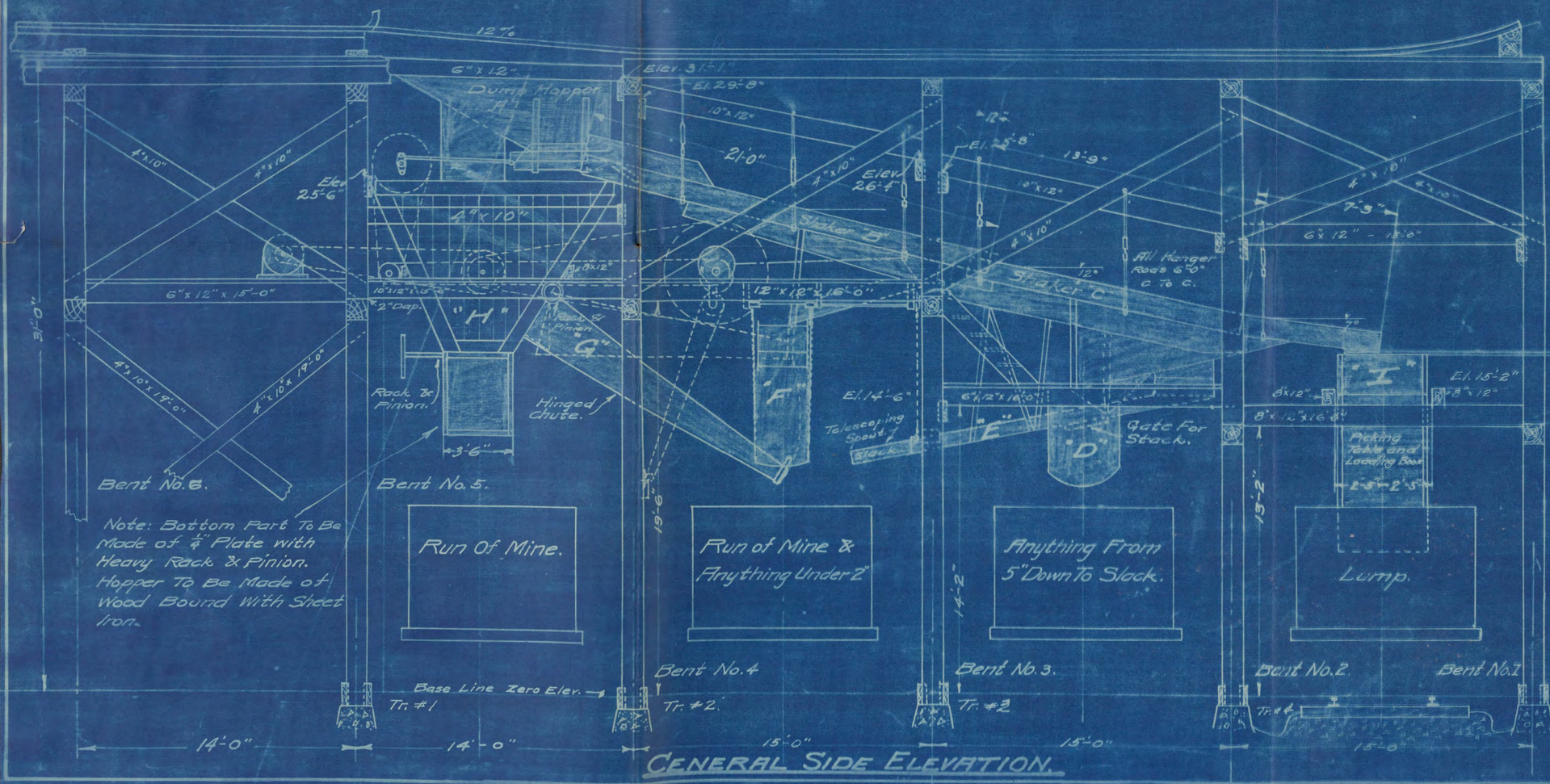
A = Length Outside.
B = Width of Eaves or Platform
C = Height of Rail to Eaves.
D = Height, rail to running Board.
E = " Overall.
I = " of Rail to Floor.

Note: Taken from Mining Catalog.

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1-5-1921.

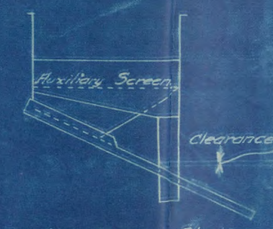


Plan Showing Shaker Drive and Feed Plate Drive.



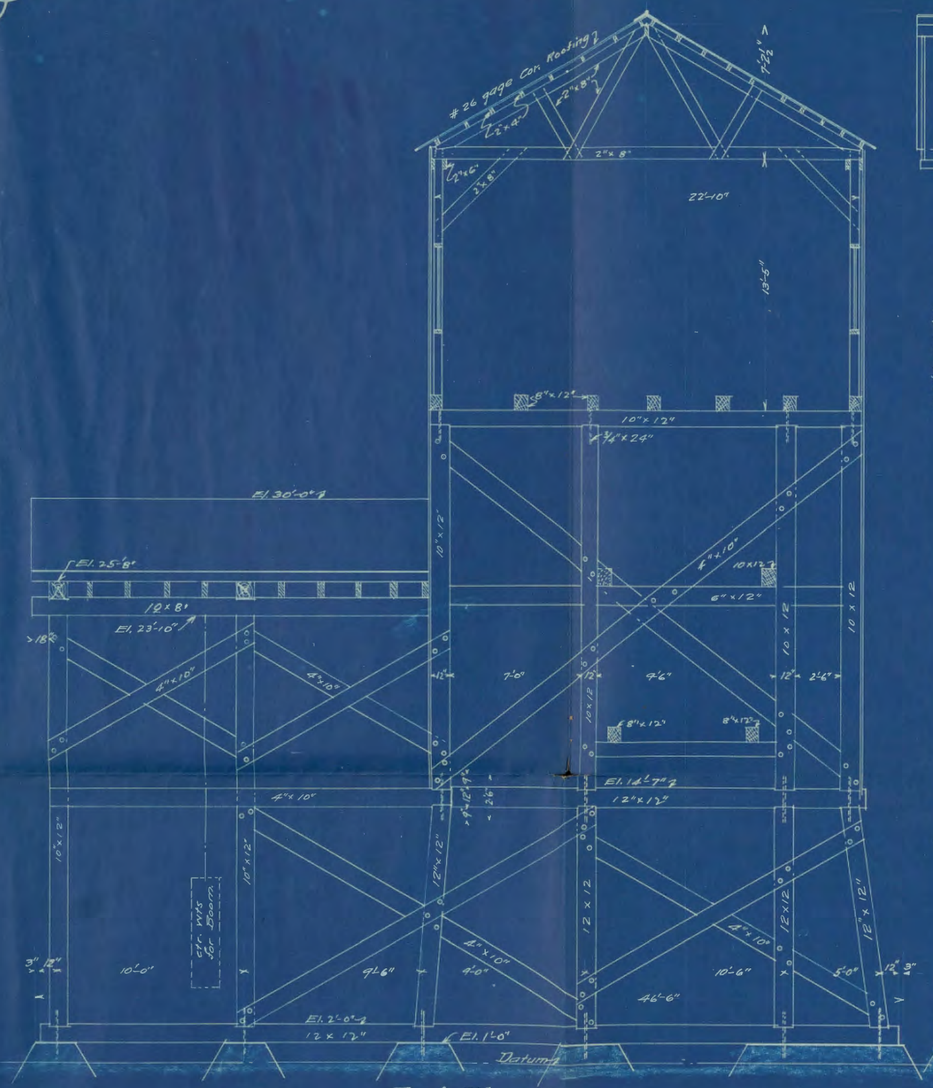
Note: Bottom Part To Be Made of ¼" Plate with Heavy Rack & Pinion. Hopper To Be Made of Wood Bound With Sheet Iron.

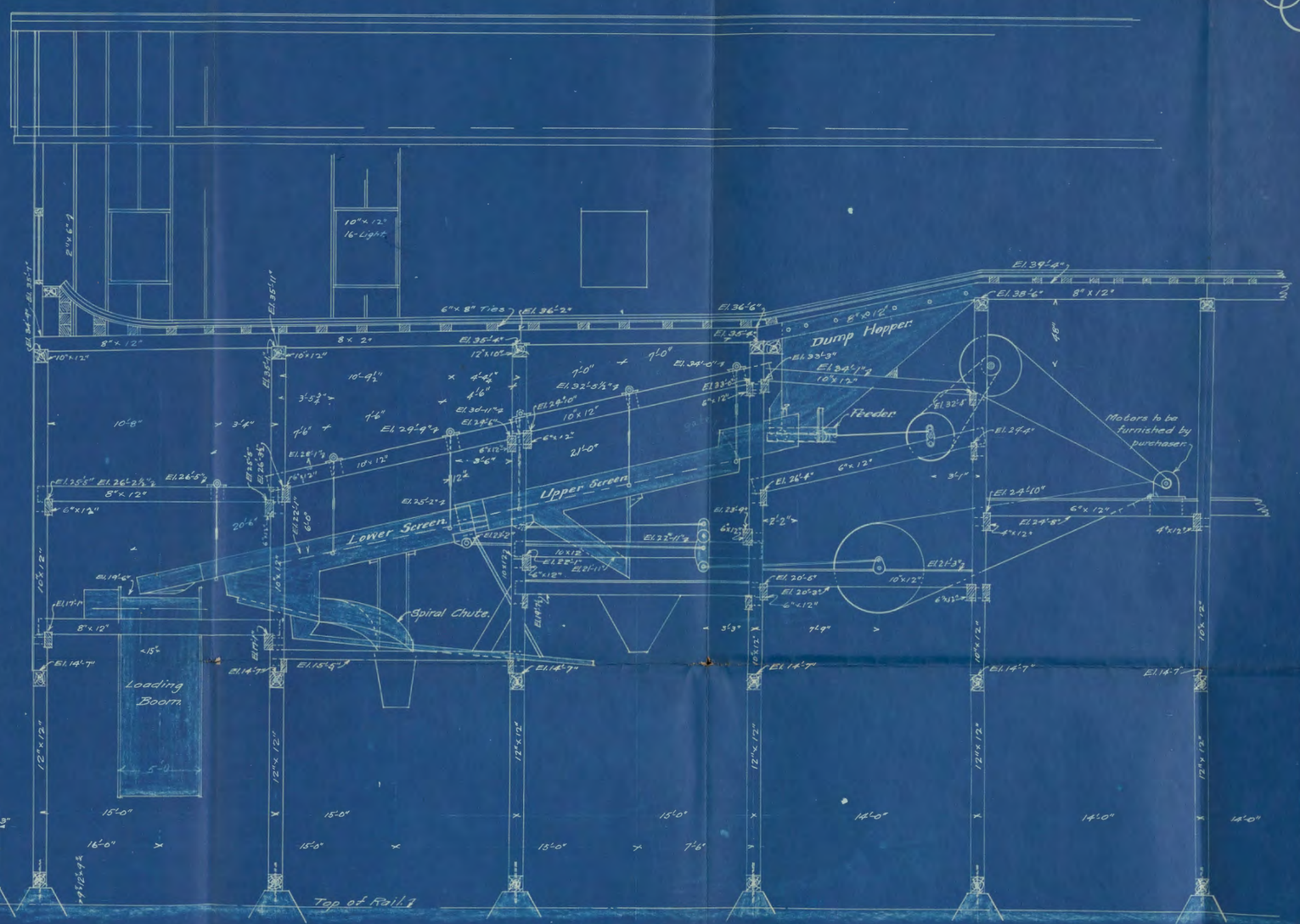
GENERAL SIDE ELEVATION.



Section Through Shaker C Showing Clearances of Nut Spout and Auxiliary Screen Spout.

PROPOSED.
SHAKING SCREEN PLANT.
GENERAL ASSEMBLY.
W. J. SAVAGE CO.,
KNOXVILLE,
TENN.
599
Scale ¼"=1'-0" (9-21-17) C.J.M.





W. J. SAVAGE COMPANY
KNOXVILLE, TENN.

General Plan of Tipple for Perkins-Bowling Coal Corp.

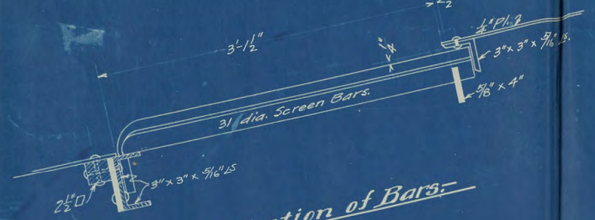
C. J. M.

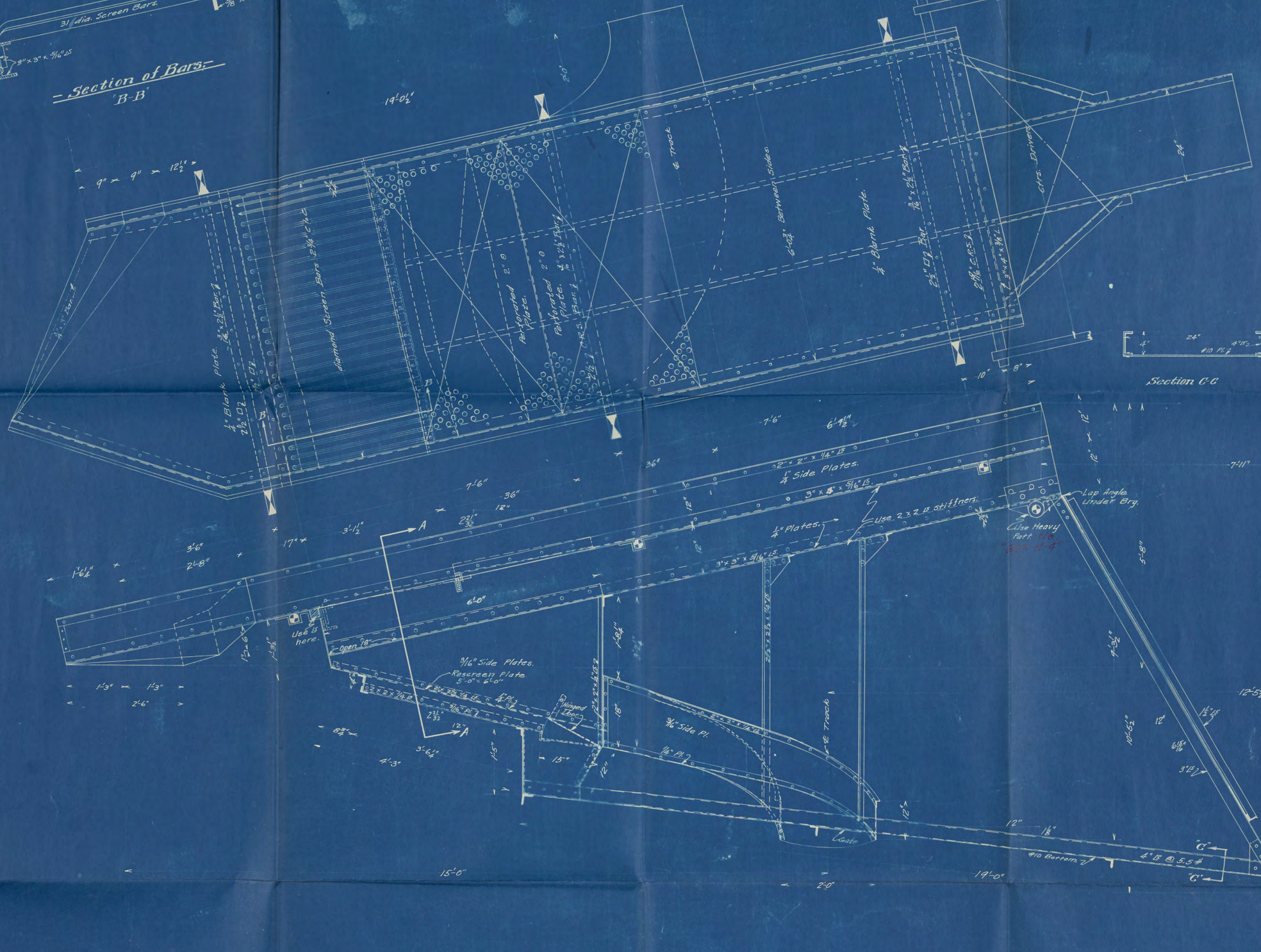
7-10-20

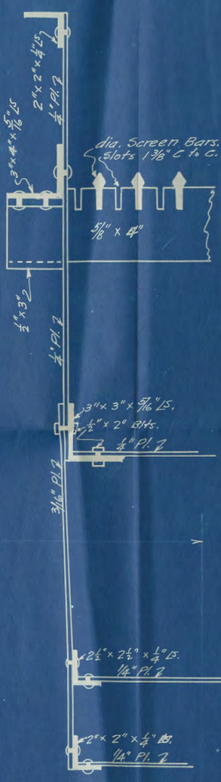
Scale 1/4" = 1'-0"

657

Section of Bars: B-B







Section C-C

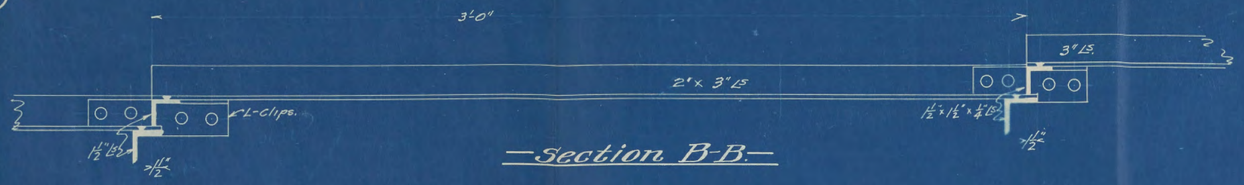
Section A-A

W. J. SAVAGE COMPANY
KNOXVILLE, TENN.

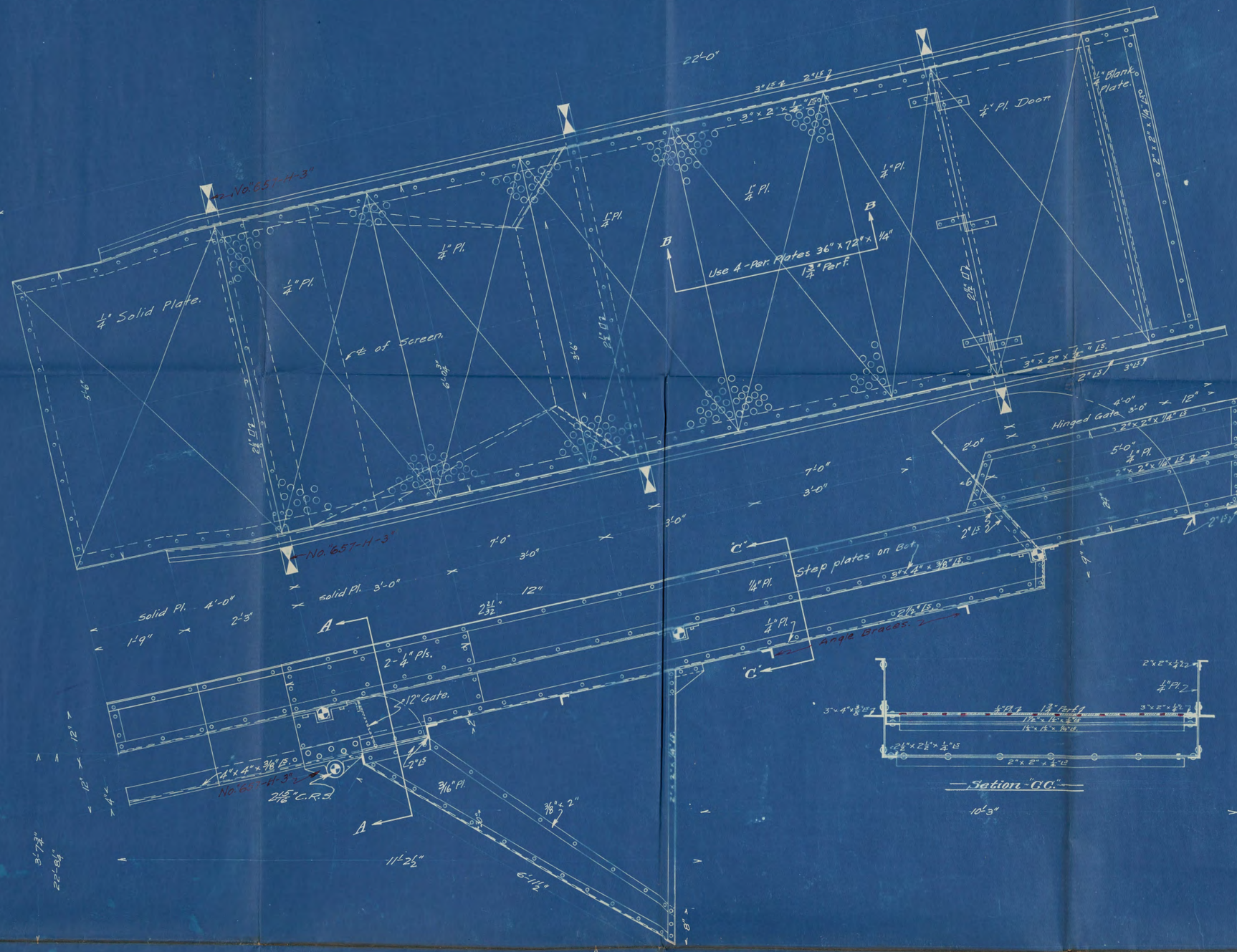
Details of Lower Screen for Perkins-Bowling Coal Corp.

Drawn by C. J. M.
Date 7-12-1920
Scale 1" = 1'-0"

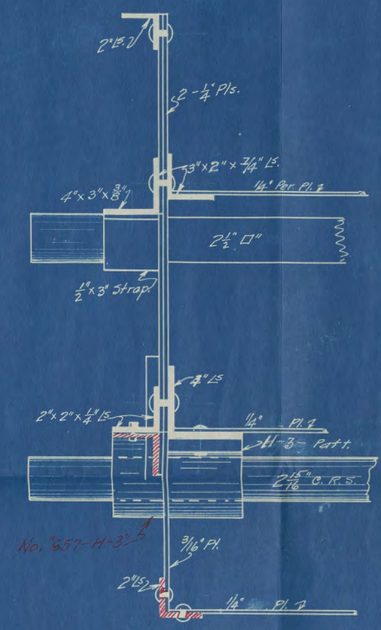
658



—Section B-B.—



—Setion "GC."—



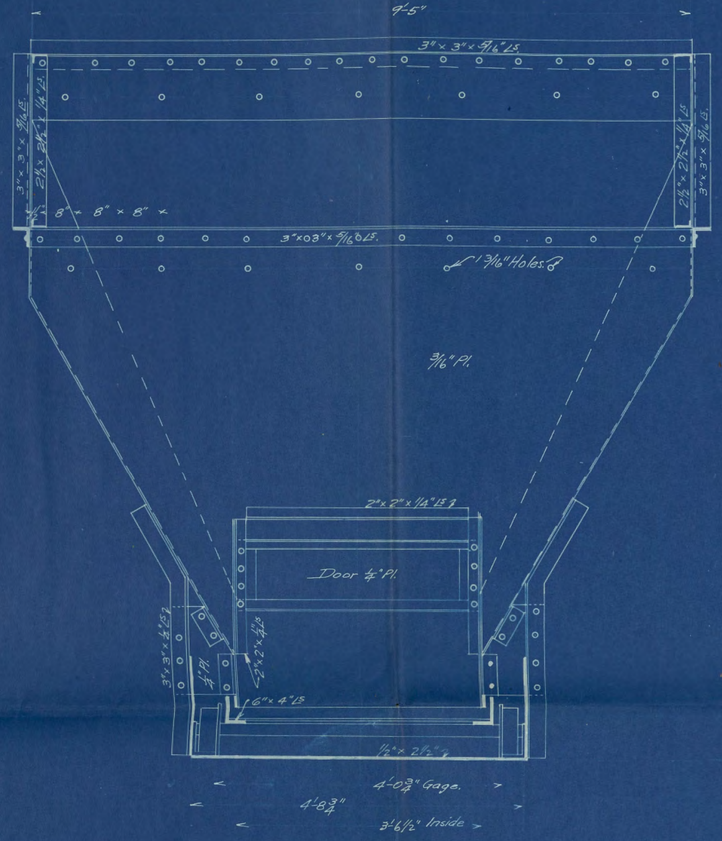
—Section A-A.—

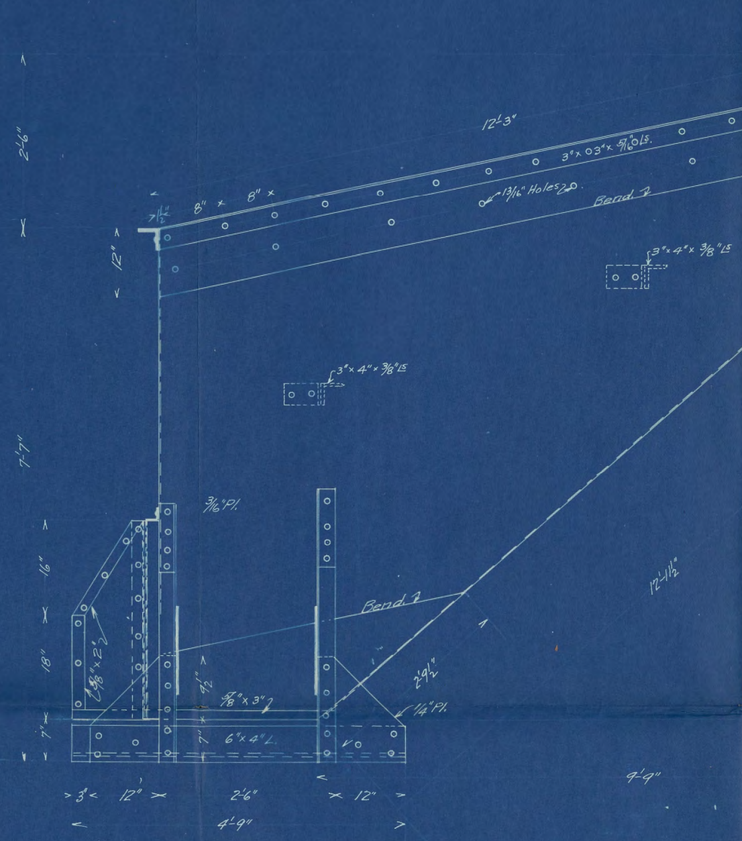
W. J. SAVAGE COMPANY
KNOXVILLE TENN.

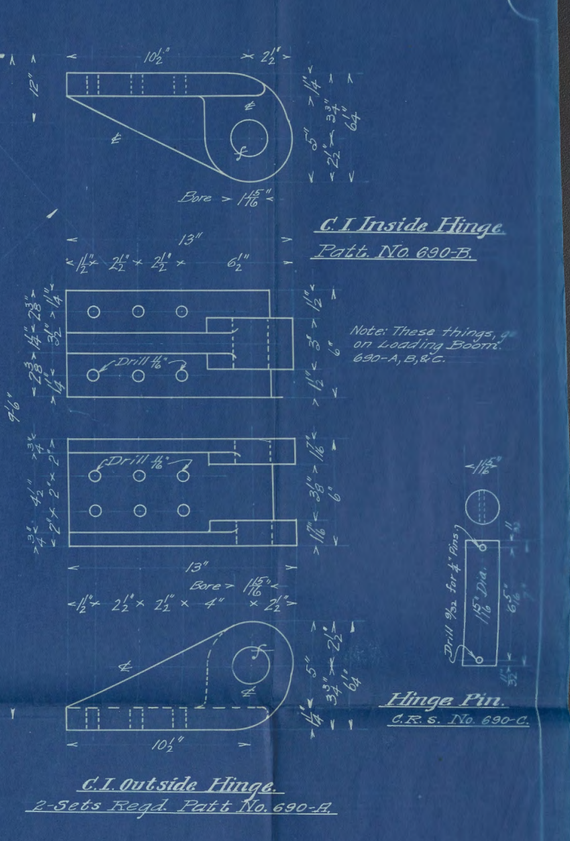
Details of Upper Screen for Perkins-Bowling Coal Corp.

Drawn by C. J. M.
Date 7-12-1920
Scale 1" = 1'-0"

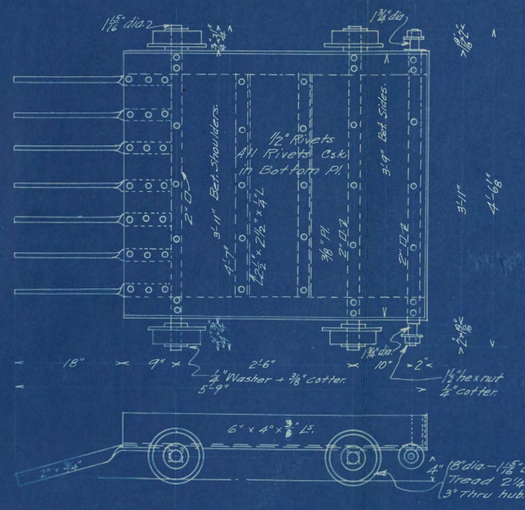
659

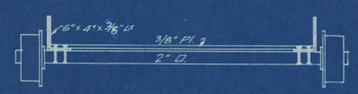




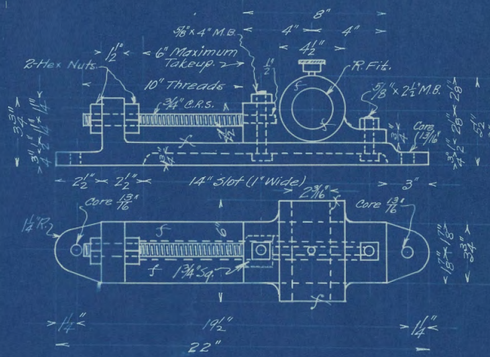


Details of Hopper



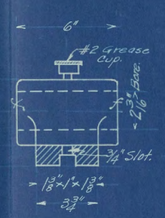


— Section of Pan —



2 3/16" Standard Single Take Up.

2-Reqd. on Boom.

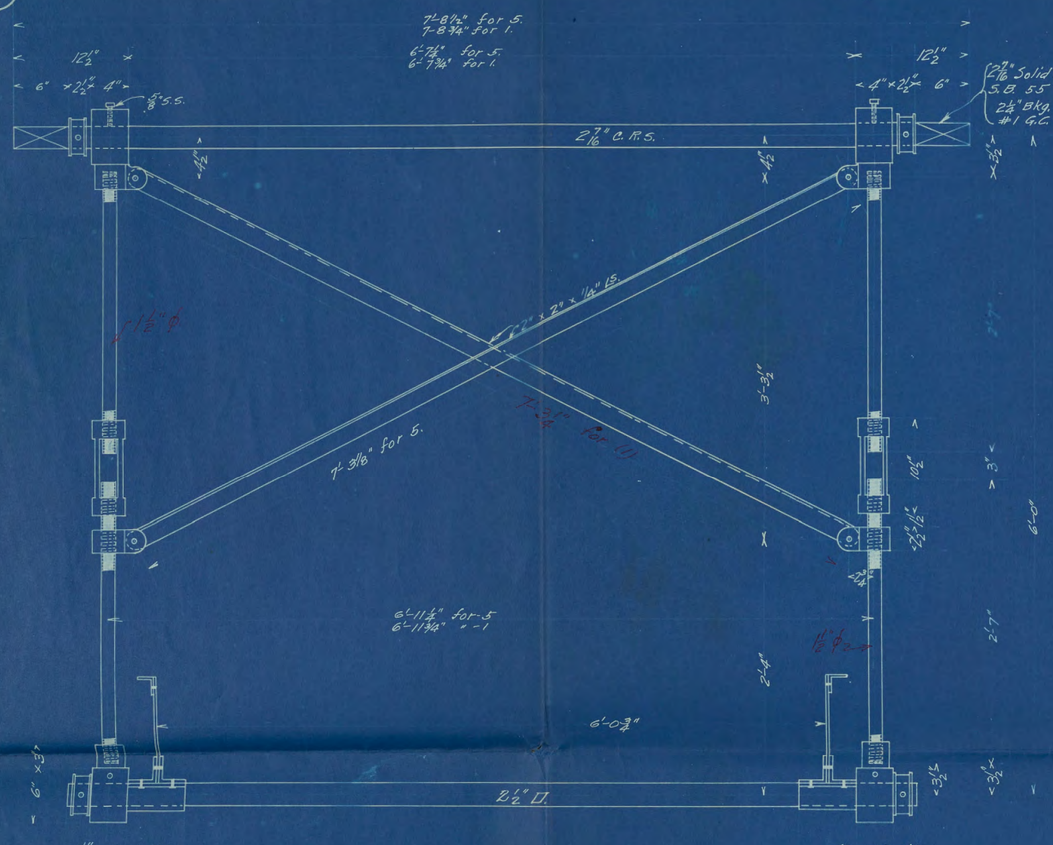


W. J. SAVAGE COMPANY
KNOXVILLE, TENN.

Details of Hopper and Feeder for Perkins-Bowling Coal Co.

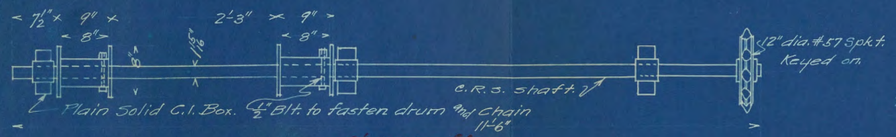
C. J. M.
7-13-1920
1" = 1'-0"

660

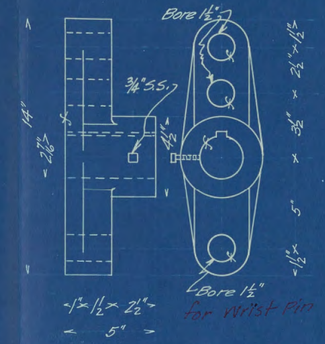


Hanger System for Shakers.

6-Sets Rqd.

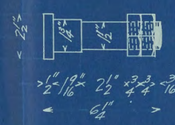


Wind Up Shaft.



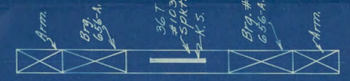
Arm for Pitman Rods.

2-Rqd. C.I.



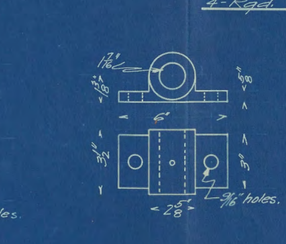
Wrist Pins for Arms.

2-Rqd. C.R.S.



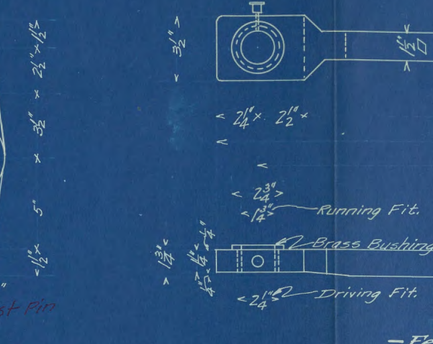
Feeder Drive Shaft.

1-Rqd. 2 7/16" x 3'-11" C.R.S.



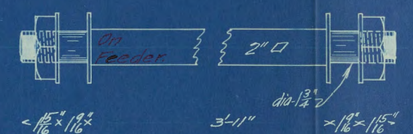
Wind Up Crank.

1'-0"



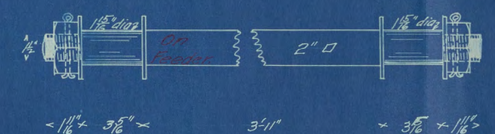
Feeder Pitman Rods.

2-Rqd. W.I.



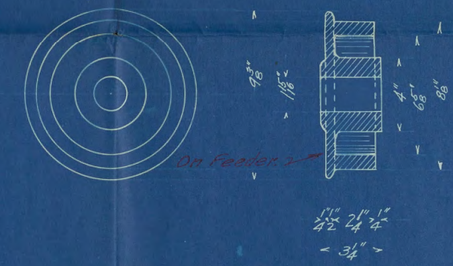
Drive Axle.

1-Rqd. W.I.



Wheel Axles.

2-Rqd. C.I.



Flanged Wheels.

4-Rqd. C.I.

Common Flat Boxes.

2-Rqd. C.I.

Also Furnish.

2	Drive Pitmans 11'-0" c. to c.
2	Upper Screen Pitmans 12'-8" c. to c.
2	Lower " " 15'-0" " "
1	Counter Shaft 2 7/16" x 8'-0"
1	Spkt. 15 T. #103 - 2 7/16" Bore.
1	" 36 T #103 - 2 7/16 Bore.
3	Corn. F. Bs. 2 7/16" Bore.
1	8" Face x dia. Pulley. - 2 7/16" B - C.I.
85	Ft. Leather Belt.
16	" #103 Chain.

W. J. SAVAGE COMPANY
KNOXVILLE, TENN.

Miscellaneous Details for Perkins-Bowling Coal Corp.

C. J. M.
7-14-1920.
1" & 1/2" & 3/4"-0"

662

"653-A" Side Plate. Template.

See Tig 100 - For Drilling Chain Links.

9" Pitch. "652-D"

1 7/8" Pin

2-3/8"x1¼" Csk. Head Screws.

Rough out for Clearance Only.

1¼" Square Core.

3/8" Drill.

3/8" R.

Core.

"652-A" "652-B."

Cross Section "A-A"

2"x6" Core.

Rear View of Female Die.
1-Rqd. C.I. "652-A"

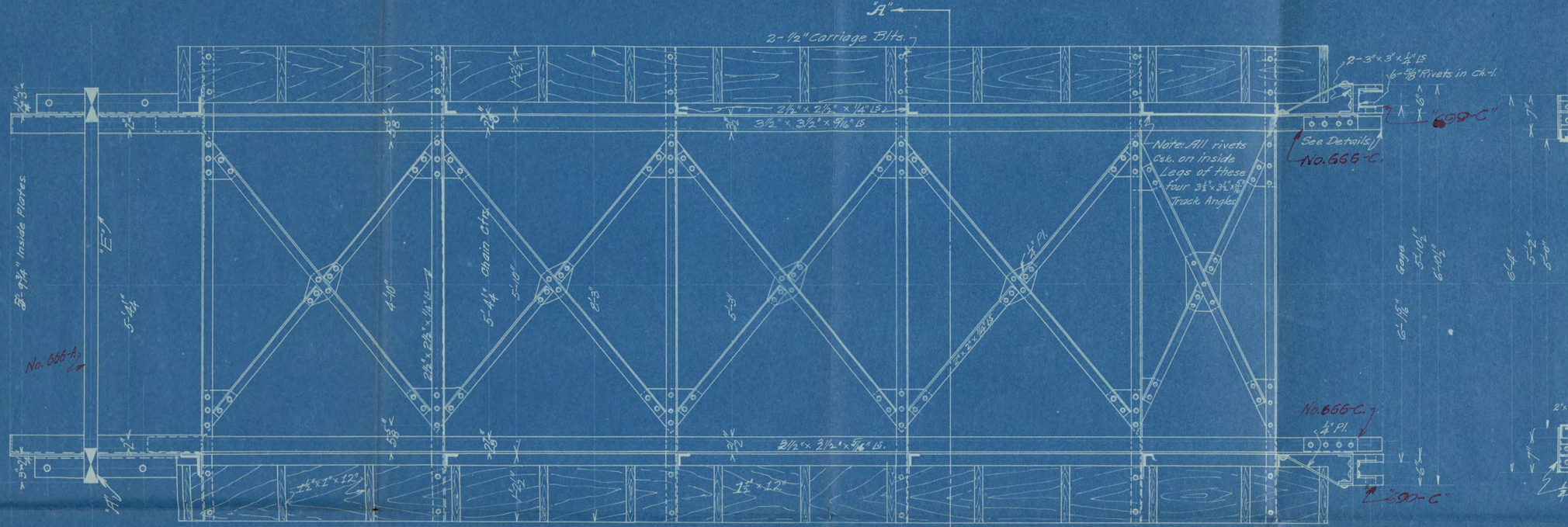
Rear View of Male Die.
1-Rqd. C.I. "652-B"

W. J. SAVAGE COMPANY
KNOXVILLE, TENN.

9"P x 5'-0" Long Loading Boom Flight Die.

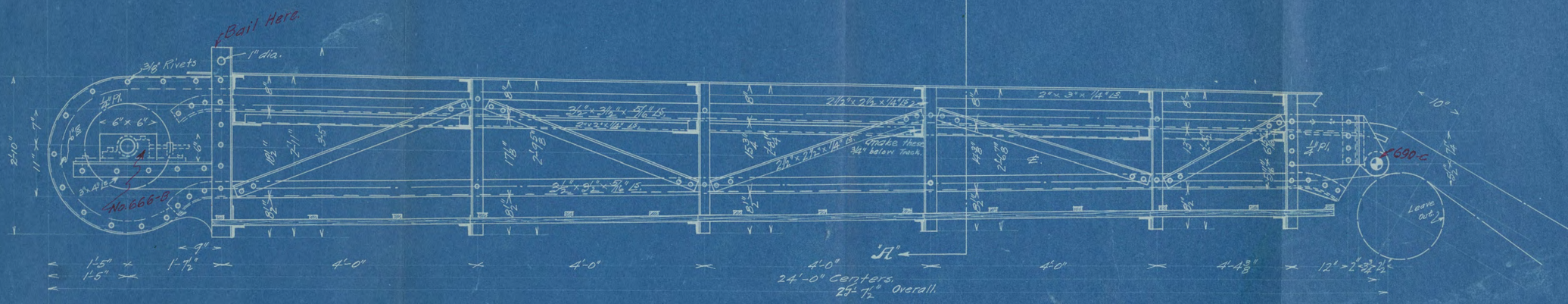
Drawn by C. J. M.
Date 7-20-20
Scale 12" & 1½" = 1'-0"

665

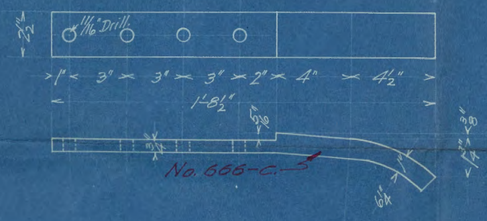


General Plan of Hinged Boom.

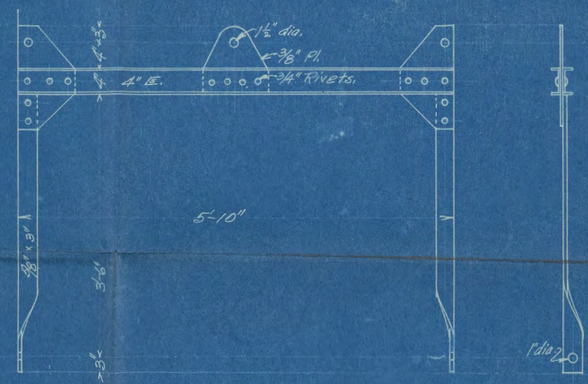
Cross Section "AA"



Side Elevation.



Forged Filler Bar



Detail of Bail

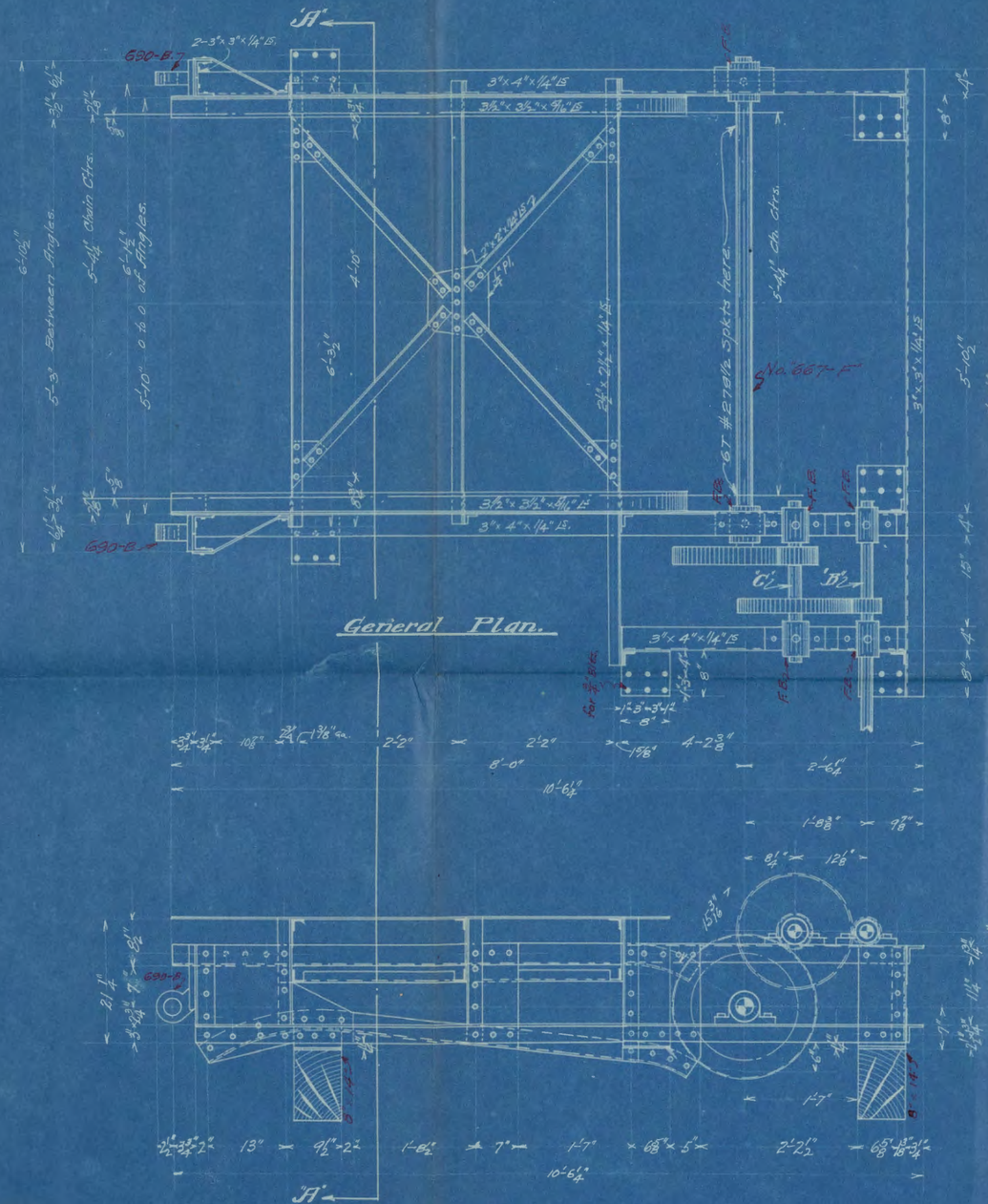
Note: All Rivets 3/4" unless otherwise Specified See Drwg. No. 667.

W. J. SAVAGE COMPANY
KNOXVILLE, TENN.

Standard 24'-0" Center Boom.

Drawn by C. J. D.
Date 7-21-20
Scale 1"=3"=1'-0"

666.



Note: All rivets ⅞" unless Specified different. See Dwg. No. 666 for Lower End.

W. J. SAVAGE COMPANY
KNOXVILLE, TENN.

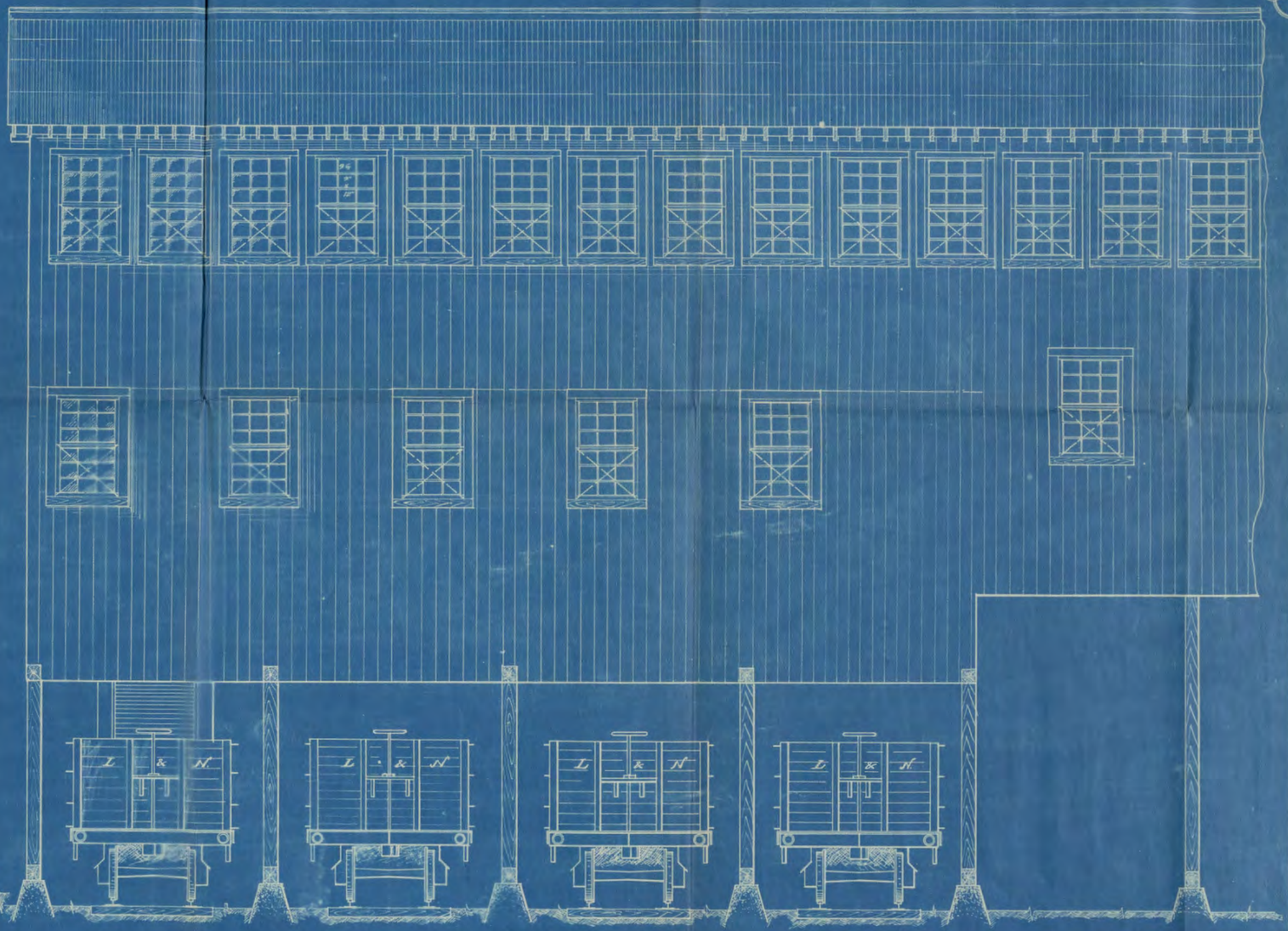
Standard 5'-0" Leading Beam - 8'-0" C. to C. Table.

Drawn by C. J. M.
Date 7-26-1920.
Scale 1" = 1'-0"

667.

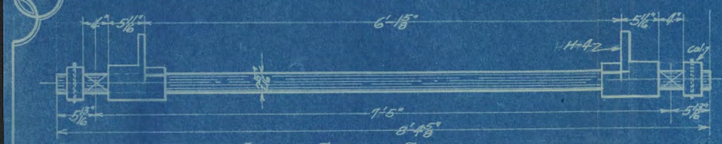


—End Elevation:—

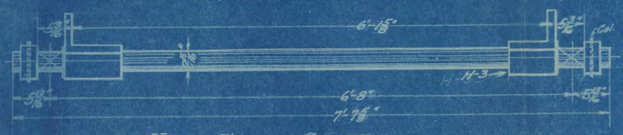


—Side Elevation:—

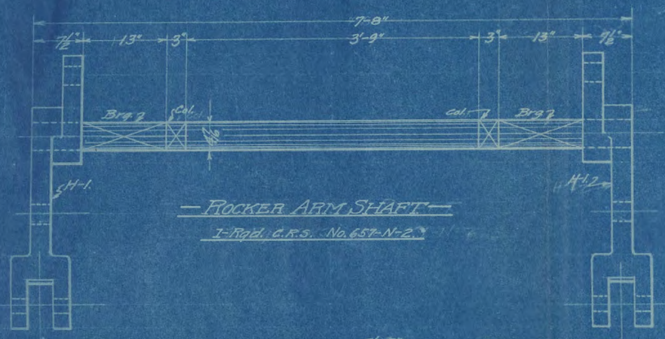
—Tipple House Elevations:—
for Perkins-Bowling Coal Corporation,
Lexington, Ky.
Built By: W.J. Savage Company, Inc.,
Knoxville, Tennessee.
Designed By: C.C. Murray. Univ. of Tenn.
1-30-1921 Scale: $\frac{1}{4}$"=1'-0" Dwg. No. 696.



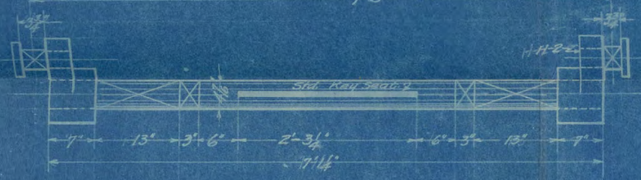
—Lower Screen Shaft—
1-Rqd. C.R.S. No. 657-N-4.



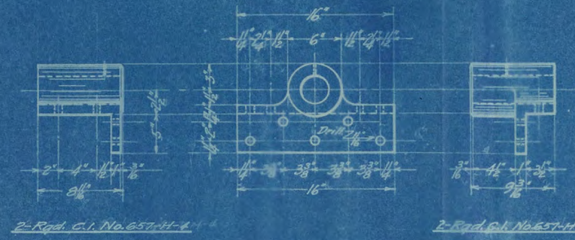
—Upper Screen Shaft—
1-Rqd. C.R.S. No. 657-N-3.



—Rocker Arm Shaft—
1-Rqd. C.R.S. No. 657-N-2.

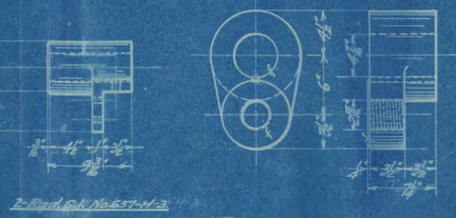


—Pcy. Wheel Drive Shaft—
1-Rqd. C.R.S. No. 657-N-1.



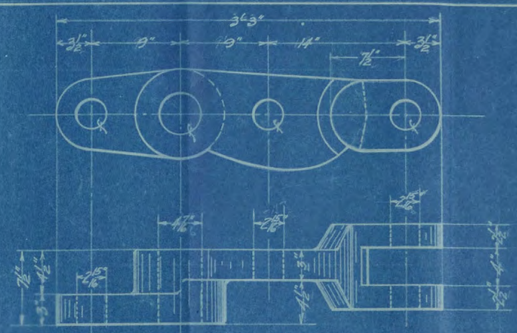
2-Rqd. C.I. No. 657-H-4.

—Details of Bracket—

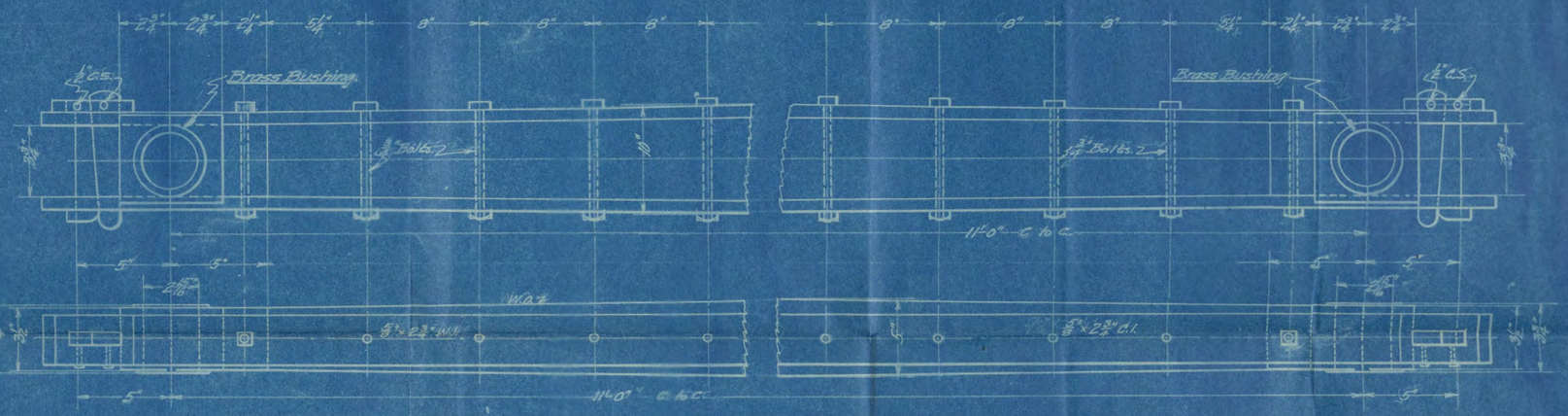


2-Rqd. C.I. No. 657-H-3.

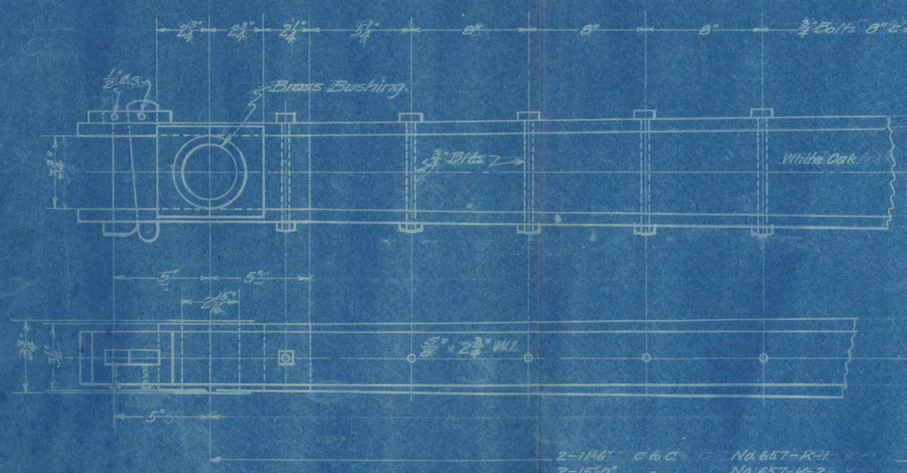
Drive Cranks
2-Rqd. C.I. No. 657-H-2.



—Rocker Arms—
2-Rqd. C.I. No. 657-H-1.

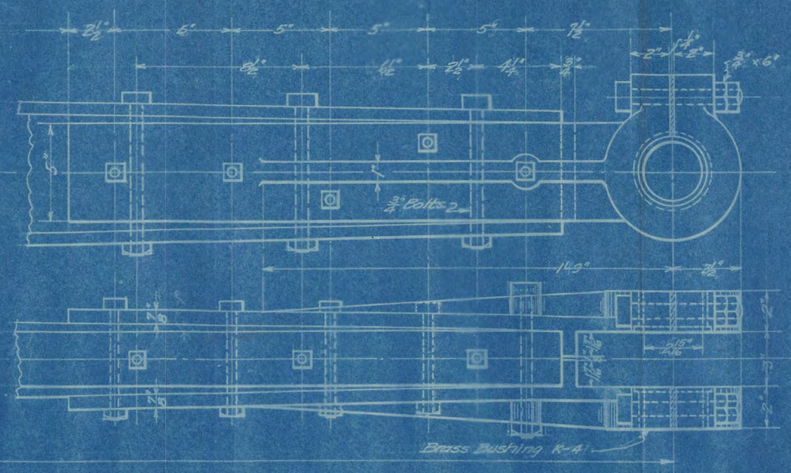


—Crank Drive Pitmans—
2-Rqd. No. 657-K-3.

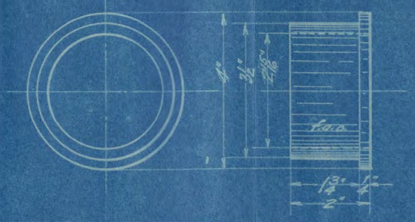


2-114" C to C. No. 657-K-1.
2-150" " No. 657-K-2.

—Shaker Pitmans—
2-Rqd. No. 657-K-1 2-Rqd. No. 657-K-2.



Brass Bushing K-4.



—Brass Bushing—
8-Rqd. Brass No. 657-K-4.

—Miscellaneous Screen Details—
for Peridas-Bowling Coal Corporation,
Lexington, Ky.
Built By W. J. Savage Company, Inc.,
Knoxville, Tenn.
Designed By C. J. Murray - Univ. of Tenn.
Date Jan. 8, 1921. Scale 1" = 1'-0"
Dwg. No. 6.99.