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These reports of the Kansas State Mine Inspector mostly concern coal mining, though by 1929 the scope of the reports broadens to include metal mines. The content of individual reports will vary. The reports address mining laws and mining districts; industry production and earnings; fatal and non-fatal accidents; accident investigations and transcripts of oral interviews; labor strikes; mine locations; mining companies and operators; and proceedings of mining conventions. The reports document the political, economic, social, and environmental impacts of more than seventy years of mining in southeastern Kansas.

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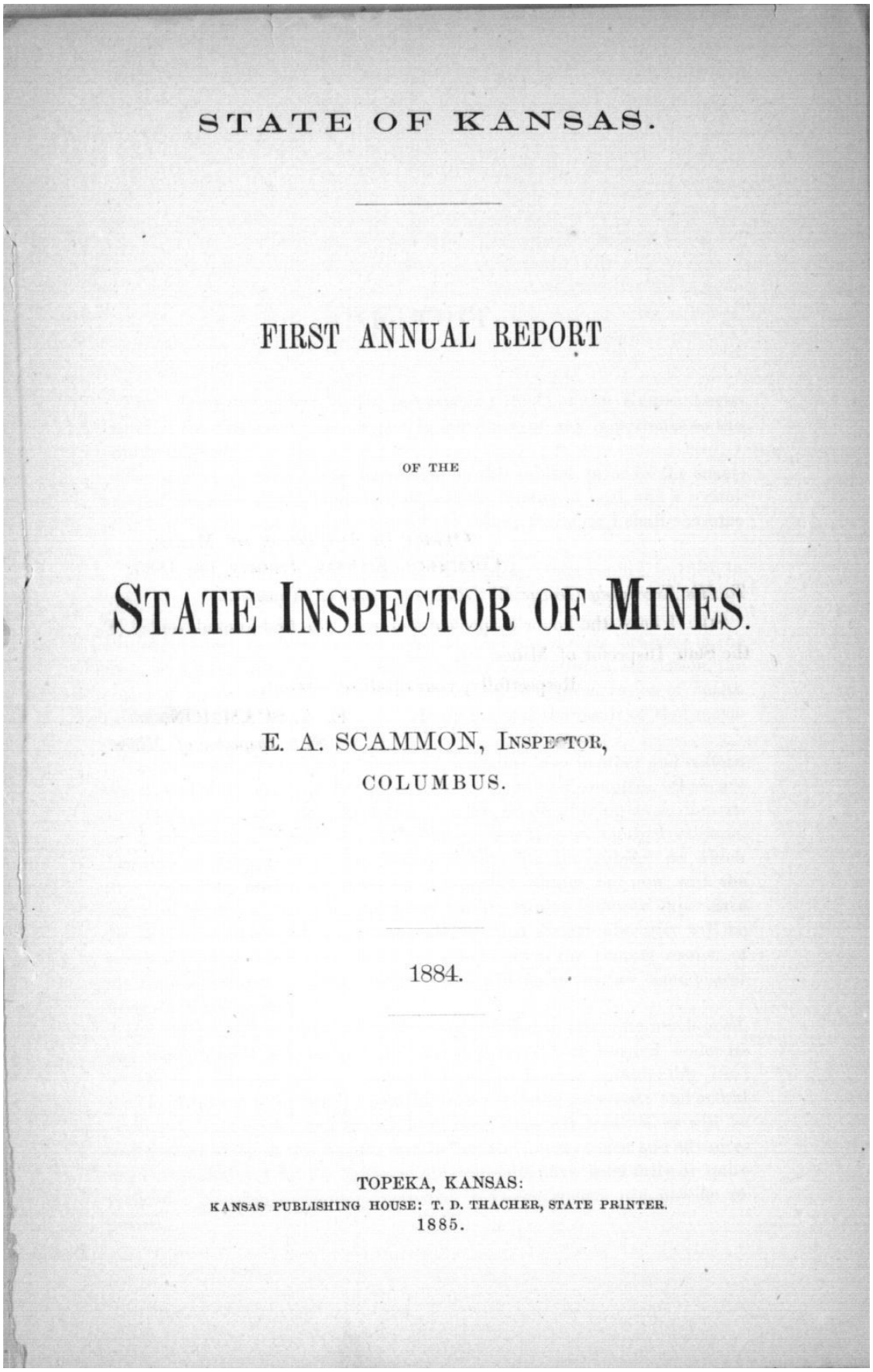

STATE OF KANSAS.

FIRST ANNUAL REPORT

OF THE

STATE INSPECTOR OF MINES.

E. A. SCAMMON, INSPECTOR,
COLUMBUS.

1884.

TOPEKA, KANSAS:
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1885.

OFFICE OF INSPECTOR OF MINES,
COLUMBUS, KANSAS, January 1st, 1885.

To His Excellency George W. Glick, Governor of Kansas:

SIR: I have the honor to present herewith the first annual report of the State Inspector of Mines.

Respectfully, your obedient servant,

E. A. SCAMMON,
State Inspector of Mines.

REPORT.

THE mining law passed by the last session (1883) of the Kansas Legislature, is the first law on the subject in our State, of any importance to the mining interests.

The ineffectual attempts at legislation on this subject, prior to the enactment of the present law, in no way affected the mining of coal, and a recital of it here in this report is of no practical value; therefore I shall consume no time or space in making mention of it.

The accidental burning of a shaft at Carbondale, Osage county, in 1881, in which five lives were lost, was the cause of arousing the miners of the State into action leading to legislation, and when the following session of the Legislature met, in January, 1883, the miners from various localities in the State sent in petitions to the members, asking some form of legislation, the object of which should be the protection of life and preservation of health in the mines of the State; and our mining law was the result of that movement.

The present law was drawn largely from similar laws in other and eastern States, and while many of the provisions are good and complete, others are ambiguous and uncertain; yet, taking the law as a beginning on so important a subject, it is perhaps as good as many new laws on kindred subjects. Legislators inexperienced and unacquainted with the subject on which they are acting, can at best make only imperfect statutes, but now, with the practical results of two years' operation, and the mining interests' experience for that time to enlighten our law-makers, much former obscurity will be removed, and we shall very likely be able to get at the coming session of the Legislature some needed changes which will make the law come nearer what the interests demand.

But the present law has not by any means failed in attaining much good, and many needed reforms and improvements have been secured under its provisions. The danger of the occupation has become considerably less; the healthfulness is far better; security from accidents increased; and actual accidents, fatal, severe and trivial, have been evidently lessened, as will be seen further along in this report; and in fact the improvement and advancement contemplated by the law in mining pursuits have been fully or quite realized. No such accident as occurred in Osage county can now be repeated.

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A number of miners lost their lives by the shaft in which they were working accidentally taking fire from the furnace below, used for ventilation, and there being but one opening, no escapement shaft, five poor creatures perished, asphyxiated by smoke and carbonic acid gas.

Now, under the mining law, all shafts must have two openings to the surface, so that in case of fire or any other unforeseen accident occurring, men may have a way of escape. This provision has been fully carried out, and all our shafts have two openings, with a very few exceptions, where the business is so meager that the owners have preferred to suspend rather than incur this additional expense. There are some new shafts recently sunk, the proprietors of which have not had the time to make this improvement; and in this regard the law is imperfect, as it makes no provision whatever for the length of time new shafts shall have in which to make these second openings.

There was a great necessity for improvement in ventilation, and there is much room yet for advancement in this matter, and will be until many of the old mines are worked out and abandoned, and new ones started on correct plans; yet the ventilation has been greatly improved. Many mines were very poorly ventilated, some even intolerable; the methods and means employed were crude and imperfect, consequently the supply was insufficient and the quality or purity of the air was tainted, and could not impart the vitality and vigor to the miner essential for the proper and comfortable prosecution of his labor. No one without experience in bad air can form a correct idea of the disagreeable effects on the laboring man of foul air; the suffering and misery is really indescribable, and no man should be subject to such punishment.

The very best air that can be carried through underground work becomes more or less vitiated, and the effect of this polluted air in long employment underground is plainly seen in the pale, anemic face of the miner.

No estimate can be placed upon the value of air. Our comfort, health and life depend upon it; its withering and destructive effects are soon felt by mankind when subjected to an insufficient quantity or a polluted quality. In searching for hidden treasure beneath the earth's surface, man must provide the means for this vital fluid to accompany him. An abundance of fresh, pure air must go with man in all his pursuits. Much interest is felt in this subject in all mining communities and there has been a marked improvement in ventilation in our mines since the enforcement of the mining law. More attention is being given to the subject; different plans and methods are being discussed, and an interest has been aroused that will accomplish valuable results; better qualified men are being employed to look after and superintend this important matter.

While the furnace is yet almost entirely used as the means employed, our very best educated and most practical superintendents are taking them out of the mines and substituting the fan. We have now a number of fans

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in practical operation, while eighteen months ago there was not one in use in the State; they work admirably, and accomplish all that can be desired in the way of ventilation.

The interest felt in this feature of mining (ventilation), and the improvements being made, are encouraging and satisfactory.

The percentage of accidents, fatal and otherwise, has been greatly reduced, as will be seen further along, and a comparison with other States is much in our favor.

The provision preventing boys under twelve years of age from entering the mines, and those between twelve and sixteen required to attend school three months and be able to read and write, is a wise and good provision, and I find no opposition to it, only occasionally some of our foreign-born citizens are inclined to be indifferent to the value of the provision, and would like to have the help of their boys in the mines; but this includes only those who have recently come to this country, and are unacquainted with American customs and institutions, and thus do not estimate the value of education like native Americans or naturalized citizens.

All the minor points of the law have been generally observed, and in proportion to their importance their effects have been attained.

The operators as well as the miners are very glad to have a law of this kind, and instead of any opposition to the law, it has been accepted, with perhaps one or two exceptions, with much favor by both operator and miner.

The operators are willing to make the required improvements and direct their business according to and in conformity with the legal requirements. They feel that the statute is a protection to them, and by its strict enforcement much responsibility is removed from them, which is the fact; the line of responsibility is drawn between operator and miner so that each understands his relation to the other.

CHANGES IN THE LAW.

Sec. 1, relating to the making of plats, should have a penalty attached for the violation of it, the same as other sections. The law provides no punishment whatever for a violation of this section.

The operator can make a plat or not, as best suits him, and the inspector has no power to compel obedience or punish the violator. In case of non-compliance with this section, the inspector is authorized to make a plat, but in order to do this he must employ an engineer or surveyor and a number of assistants, and pay them out of his own pocket, because there is not a surveyor in the State who will hire his help and make a plat and take his chances of collecting his bill at the end of a protracted lawsuit. The operator who will not obey the law and will not make a plat as the law directs, will not pay for having it done against his will, only at the end of a long-protracted and vexatious lawsuit. The Inspector has to stand between the surveyor and operator, stand good for the surveyor's bill, pay it, and then take his

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chances in court of collecting of the operator, of being beaten by tricky lawyers; and again, it is a very disagreeable task to enter the mine of an ill-disposed operator, who will throw every obstacle in your way and render it almost impossible to perform the work accurately, saying nothing of the discomfort and unpleasantness. Section 16, which provides penalties for the violation of other sections, leaves section 1 out entirely.

There should be a penalty attached to section one, so that in case of violation the Inspector could cause the arrest of the violator and have inflicted a fine.

The law makes no provision for new shafts, or shafts put down and mines opened since the law became operative. For instance, a new shaft is opened ready for business: how long shall it have to make the improvements and carry out the purposes contemplated by the law? It is silent on this matter, and has caused much annoyance and misunderstanding. New shafts are sunk and mines opened almost daily, at this early stage of mining in our State. The section of the Illinois law on this subject is a very good one; it provides that not more than ten men shall work in the mine, and that the escapement shaft shall be sunk not less than one hundred feet each year until completed, and all the provisions of the law observed.

Those sections referring to second openings or escapement shafts are obscure and unsatisfactory; they should be plain, certain, and incapable of misinterpretation, and simply state that all mines shall have an opening to the surface other than the hoisting shaft, in which shall be substantial ladders or stairs convenient for the miners to go up and down, to be kept constantly in order and repair, and to be used for no other purpose that will in any way obstruct or impede free and convenient travel. As it is now in many mines, this escapement shaft is used as the upcast to the furnace filled with smoke and hot air, and in case of the necessity to use them it would require considerable time to prepare them so that men could use them as a means of egress.

If permitted to use them as the upcast to furnace, the opening should be divided or partitioned so that one side could be used for this purpose and the other as a travel-way. The partition would have to be of incombustible material for some distance up, to prevent the possibility of catching fire from the furnace.

In section 8, the first paragraph of which refers to fencing around the top of the shafts to prevent accidents, (and it is a very important matter, accidents often occurring at this place for lack of proper protection,) the law uses the phrase "properly fenced off." I have never yet had two men agree what constitutes a "properly fenced off" top. What one may consider proper another may deem it quite improper. This equivocal use of words in the statute has defeated the object or intention of law in many instances.

The section should be definite and say how high the fence should be, and sufficient material used to prevent all danger of accident; and that side of

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shaft that has to be used, should have gates attached, which should be kept closed only when actually necessary to use them open; and at all landings where coal boxes are caged a gate should be provided to work with the cages, closing the opening at all times, only during the unloading of the cage.

Most all the mining laws of those States which have them, require an examination of all applicants for the position of mine inspector; and I believe it very important that our law should not be an exception to this general rule. The incumbent of this office should possess a competent knowledge of chemistry (which covers a knowledge of gases), mining engineering, the systems of working and ventilating mines. The nature and properties of poisonous and noxious gases, especially fire-damp, should be thoroughly understood. He should have a fair knowledge of geology and mineralogy. These are indispensable qualifications for the creditable and faithful discharge of the duties of this office. The only fair and proper way to test the qualifications and bring out a knowledge of these above requirements, is to have all candidates examined by a board of competent examiners, and all candidates passing a fair examination to receive a certificate of competency, good say for five years, in the State.

The board of examiners should certify up to the Governor a list of all successful applicants for him to select from in making the appointment of mine inspector. The Illinois law provides for the Board of Labor Statistics to appoint the examiners, and requires them to select for such board two operators in coal, two miners, and one mining engineer. In our State we have the State Board of Agriculture in place of Labor Statistics, who could perform the duty of selecting the board of examiners. The expense attending the board of examiners would be trifling, and the results would be much more satisfactory to all concerned. It would relieve the Governor of an annoying responsibility; he would be sure to get a qualified man, and the candidate appointed would have some protection from the maledictions of unprincipled detractors.

The board of examiners should be required to issue a circular to all applicants, announcing the character of the examination (which should be moderate and fair), and other information, such as time and place of holding examinations, and anything else of interest pertaining to the subject.

COAL DISTRICTS.

The workable coal beds of the State of Kansas, so far discovered, are limited to an infinitely small portion of the surface of the State.

In the southeastern portion of Kansas and western Missouri, lies a very large coal field of several hundred square miles, but to the misfortune of Kansas the larger portion of this deposit lies in Missouri. This bed of coal enters the eastern State line in the neighborhood of Fort Scott, and extends south a distance of nearly fifty miles. This same vein very likely projects into our State near Rich Hill, Missouri, and Pleasanton and La Cygne, Kansas; but the heaviest and most valuable portion crosses the line of

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Crawford and Cherokee counties, extending southwest into our State fifteen miles; it may run deeper and extend much further, but so far there has been no development of it.

The vein lies near the surface, and in many localities the superincumbent earth is removed and the coal mined in open day. Most places where it can be profitably mined this way (stripped) have been worked out, and now very much the larger portion is mined by shaft; in fact very little is now stripped. The coal is a superior bituminous quality, being rich in bitumen and other products of carbonized vegetable matter. It is superior for gas purposes to any thus far used west of the Mississippi river. There are two qualities. The red, or rusty as it is called, is some lighter than the black resinous, and for cooking and smithing purposes it cannot be surpassed anywhere. It is free from sulphur, or any inorganic deposit, and burns as free as dry wood, making considerable blaze and leaving a light ash without any trace of clinker; makes little smoke and scarcely more soot than wood; it will burn in wood stoves without grate or underdraft.

This coal is that usually found by stripping, lying near the surface, and I think its rusty appearance and pure quality is from atmospheric action and the constant percolation of water through it, because as it passes from the ravines and lower places, where it is usually found, into the side embankments, or if it dips and becomes deeper and thicker, it loses this appearance and becomes blacker and heavier, and forms the other kind. This rusty coal is not always found in depressions and lower places; near Fort Scott, where the largest amounts have been mined, it is found on elevated plateaus and rather hilly ground, but it is not so thick as the black, and is always much nearer the surface. There is but little of the rusty coal left, and soon will be none, unless new discoveries are made.

The black, heavy, oily kind is deeper, and has a slate roof and frequently several feet of sandstone overlying it. The most of this quality so far mined is not over sixty feet from the surface, and runs nearly four feet thick, from 3 ft. 6 in. to 4 ft. 2 in. This is undoubtedly the best quality of coal mined in the State.

It extends along the southeast portion of the State, in Cherokee and Crawford counties, extending over, is worked fifteen miles from the Missouri line. Recently in Crawford county this vein has been discovered 120 feet deep, and some is now being mined this depth. The stratum immediately above the coal is similar to that nearer the surface, having a thick, black slate roof. There is a considerable advantage in mining this vein at this greater depth; the management of the water will very likely be confined to that which the shaft itself makes, and will be easily managed. The works will very likely make no water, and this will be a great saving in expense and annoyance, besides frequently a very formidable matter to manage. The falls breaking clear from the surface that so often trouble us will not occur in this deep mining; but for these advantages it is possible to offset them; we may have

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generated some gas to contend with, but this is quite unlikely, as the superincumbent earth is not of a solid compact character, and if any gas is generated it probably passes off as fast as formed. This coal as well as that more superficial has slight faults, or more commonly called "horsebacks," which are troublesome and an impediment to cheap and easy mining; they interfere badly with systematic mining, and in the management of them the miner is governed by the situation as he finds it, which often breaks badly into the system or plan of mining.

The market for this coal is chiefly over the Kansas City & Gulf Railroad, north to all points in eastern Kansas and Nebraska and western Iowa and Missouri; and a large amount is shipped over the St. Louis & 'Frisco Railroad east into Missouri, and west as far as Wichita and Halstead. The Lawrence & Southern Kansas Railroad has now an opening to these mines, and coal is carried to points on its line.

The Osage county coal is on the line of the Santa Fé Railroad, commencing about fifteen miles south of Topeka, at Carbondale, and extends for nearly thirty miles along this road, through the towns of Scranton, Burlingame, Dragoon, Peterton, Osage City, and Barclay. The coal is a good quality, of bituminous kind, but a little dryer and lighter, not quite so resinous or oily as the southeastern or Cherokee coal. The mines in this locality are not deep, most of them less than fifty feet, except at Burlingame, where they run a little over one hundred feet deep.

This deposit, or coal field, seems to be in the neighborhood of thirty miles long by eight or ten wide, and is quite certain to be found by sinking anywhere within the limits. The vein is light, averaging about fifteen inches at Osage City, eighteen inches at Burlingame and Scranton, and seventeen inches at Carbondale. At Dragoon creek, near half-way between Osage City and Burlingame, there appears to be in the bottom land of the creek a strip of coal nearly three hundred feet wide, and running from twenty inches to three feet thick; the coal seems to take the course of the stream—is about sixty feet from the surface. Mr. Hayson is working this coal, and mines on the pillar-stall plan; the quality is good. This coal is most likely of the same period of formation, but from existing circumstances at this time was deposited thicker than that surrounding it.

In Osage county alone there are nearly one hundred shafts, and the business of coal mining is carried on very extensively. A large number of men find employment. The vein being so light, it requires more men to make up the necessary output, and the locality gives a large advantage in freights, so that the mining of this small vein becomes a prosperous business.

The preparatory expense of sinking and rigging hoisting machinery is so cheap that almost anyone with but small means can go into the business, yet a few large companies do most of the business. They operate a large number of shafts, and do not work many men in each shaft, and do not carry their underground work any great distance from the shaft. It is economy

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with them to put down and work more shafts than to do extended work underground.

This coal is marketed in the central part of the State, diverging in all directions from the mines, and railroad companies take large amounts of it.

At Leavenworth is found the deepest coal in the State, 712 feet from the surface. The vein is twenty-two inches thick, and extends south to Lansing, the location of the penitentiary, where it is worked by the convicts under the authority of the State. I believe these two places are the only points, within probably fifty miles or more, that any test has been made to find this vein. It is more than probable that this deposit covers a very large area of country. The coal is a good quality, hard, with considerable luster, and a little inclined to be brittle.

The coal works at Leavenworth are the most extensive and the largest in all respects of any west of the Mississippi river. The trade here is largely to the city, and the company does an extensive shipping business.

In Franklin county, near Williamsburg and Ransomville, a thin vein, eighteen inches thick, is found from forty to fifty feet deep. This coal is similar in all respects to the Osage coal; the two counties join, and the coal here is a continuation of the other. Quite a trade is done here in the course of a year, a few companies doing a shipping business on the Burlington branch of the Southern Kansas Railroad.

In Neosho county, near Thayer, this same formation extends; same coal, perhaps not quite so good, as the Osage and Franklin county coal. A light business is done here, some shipping over the Southern Kansas Railroad.

In Cloud county, at Minersville, seven miles northeast of Concordia, and at a few other places in this county, is found a vein of lignite coal of an inferior quality. It is from twenty to sixty feet from the surface, and will average probably two feet thick. At Minersville, during cold weather, quite an extensive business is done. The mining is by shaft and drift. The preparation and arrangements for mining are of a cheap order. The coal is a poor article, but in this portion of the State there is scarcely any wood or fuel, and this coal is used largely by the inhabitants for a considerable distance. It sells for $4.50 per ton in Concordia, the miners getting one-half of this for the mining. It leaves about the same bulk of ashes as coal, and burns out quick, but a hot fire can be made from it.

This same kind of coal is mined at Wilson, Ellsworth county; also in Russell, Lincoln and Mitchell counties. A considerable amount is mined at Wilson during the winter months.

At Omio, Jewell county, I am informed, at a depth of 160 feet a vein of very fine bituminous coal has been discovered. I understand a company have their shaft down, and are through the coal. The vein at the shaft is twenty-six inches, and a short distance away they have drilled and find thirty-nine and one-half inches. The company is putting in steam power, satisfied that the coal will warrant the large outlay of permanent and solid machinery.

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This is a grand thing for that portion of the State, and will prove a splendid enterprise for the company operating the mine.

I am indebted to Messrs. W. H. Mead and E. E. Parker, of Cawker City, Mitchell county, for an account of prospecting for coal at that place the past summer and fall. The citizens organized a company and employed a practical driller, and at 380 feet find twenty-one inches coal, then five feet of slate, followed by twenty-two inches more coal. They are now making preparations to go down with a shaft. This is undoubtedly the same formation as the Omio coal, but may not be and likely is not a continuation. Taking a view of the map, it would indicate a breaking-off or fault in the vein between the places, and the fact of coal being so much deeper at Cawker indicates the same thing. The people in this part of the State need coal worse than any other portion, and this will supply their yearly famine for fuel.

At Newcastle, Cherokee county, and Pittsburg, Crawford county, drilling is now going on, to prospect below the present working vein. Nothing of value has yet been discovered, although they are not far down.

There are but few counties in the eastern half of the State that have no coal. Nearly every county has a vein of some character. Usually the vein is from eight inches up to thirty, and near the surface. All are more or less worked to satisfy the local demand by stripping, drifting, etc. Anderson, Atchison, Brown, Chautauqua, Coffey, Doniphan, Elk, Greenwood, Jefferson, Jewell, Labette, Linn, Marshall, Miami, Montgomery, Nemaha, Pottawatomie, Republic, Shawnee, Sumner, Wilson and Woodson, and a number of others, mine for local purposes; in the course of a year a very large amount, not less than 40,000 tons. These small mines supply a pressing want for fuel to a class that could not well do without it, such as the farming community, small towns, mills, etc. This coal is generally of an inferior quality, some of it quite rotten, yet it serves its purpose well; any of it in place of no fuel is a great boon, and saves to the consumer largely in the price of coal shipped to these localities.

COAL MINING IN KANSAS.

In most of the coal districts in Kansas, and in fact in all that are extensively worked, the surface lay of the ground is level—being prairie, and not hilly, or timbered; therefore there is but little cropping of coal, although in some deep ravines we sometimes see it, but it usually dips as it goes into the side-hills, hence our mining is done chiefly by shaft. There are a few slopes, and in some localities, where a small business is done and the surface somewhat irregular, and deep ravines exist, we have some coal mined by drifting.

The slopes are usually sunk on a pitch of twenty to thirty degrees, being not a steep incline. The coal always being near the surface, the roadway can be constructed with a slight incline, thus rendering the labor less in bringing out the coal. Where steam is used, the opening is large, for two tracks; the machinery is similar to that used in shafts, the cable working on a drum,

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bringing up a loaded train on one track while the empty coal boxes descend on the other track—the engine doing the work from the coal-level, and mules hauling to this level. They are in fact only practicable in a small business, where the work can be done with mules, and the operator is not able to make more extensive arrangements.

I doubt if they are even cheaper than the shaft, under any consideration, especially if they are to be used long, or do very much business. Where steam is not used, the slope is not less than six feet wide and five feet high, giving room for a small mule to draw the coal up from the coal-level to surface, or landing, which is built up a few feet for convenience of loading into wagons. The underground work is not materially different from the plan pursued with the shaft, only that it is usually not so elaborate, and with not the care that is used in extensive work.

In the Southeastern, or Cherokee district, the shaft is used altogether, with the exception of two or three slopes in use. The motive power is generally steam. Size of shaft, 6x12 feet in the clear, after cribbing, or timbering.

The process of opening up the coal is about as follows: In selecting the site, that portion of the tract to be mined in which the coal is the deepest from the surface is chosen, in order that the coal may be mined on the rise as much as possible. This secures natural drainage and easier delivery of the coal from the face to the shaft—the loaded cars having down grade, and the empties, up grade. In sinking the shaft, usually all that is used are simply two upright pieces firmly fastened into a foot-piece, and placed at the ends or sides of the opening; a strong cross-piece rests on the uprights, with a pulley fastened to it, over which a rope passes connected to the tub, and a horse is then hitched to the rope, and does the hoisting of the material in sinking. There is usually hard rock (sandstone) ten to twenty feet, which requires drilling and powerful explosives to break; then come several feet of black slate which overlies the coal. Water seldom gives but little trouble, and the walls stand well until the shaft is sunk and timbering completed. The timber used is usually oak plank, three to four inches thick, and dove-tailed or half-jointed at the corners. Two partitions are made, one between the cage-ways, and one cutting off two feet at one end; the end partition must be tight, as the two-feet space is temporarily used as the upcast in ventilation until the air-shaft is down, and is also used as a passage-way up and down the shaft. During the sinking and timbering the permanent hoisting structure is prepared, and is soon raised and placed in position, ready for the machinery or permanent plant. The machinery used is an engine for hoisting coal, pump for water, and boilers necessary for steam-power. The engines are from forty-five to sixty horse-power, and many are now using a double engine, with two or more boilers, so that in case of breakage or accident the business may not be shut down. In some cases pumps are not used, and the water is raised with the coal in boxes attached underneath the cages. These boxes are arranged with a valve in the

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bottom, and at lowering of the cage descend into sump, fill with 150 to 200 gallons of water during the loading of the cage; the valve closing, the water is raised with the coal, and upon arriving at the landing a connection is made with the valve which raises it, and the water runs out during the unloading of the cage. At the bottom of the shaft the sump is dug deep and large enough to hold what water collects for twenty-four hours or longer.

This arrangement, when perfect, works much more satisfactorily than pumps. Pumps are continually getting out of order, and the water is so pregnant with corrosive minerals that it will eat out and destroy pumps and iron tubing in a very short time—sometimes in eight or ten days.

The outlay and expense of getting ready to do business in this district is very large. If done on an ordinarily extensive plan to do a shipping business, it requires several thousand dollars investment—anywhere from ten to twenty thousand dollars, according to the extent of plan and scale of operations. Yet a smaller business can be done with less expense; and often it is better to commence this way, and the business proves better and lasts longer.

The main framework of the shaft is large enough for all the necessary connections with the machinery. The wheels over which the cable runs to the cages are about thirty feet high and over the center of the cage-ways. These wheels are at the summit of the top-work, and the cable passes over them, attached to the cages and drum in the engine house, the boiler and engine house being about forty feet from the base of the framework. On the opposite side a long slender building runs out about twenty feet high. This is the top landing, where all the coal is unloaded. The tipple is here, which dumps the coal into the screens, which divide the coal into lump, nut and slack. Under the screens run the railway tracks; and under the track are the large scales for weighing a car-load at a time; also, these scales weigh each box of coal as it comes from the mine, after passing over the screens, taking out the nut and slack.

The underground work I suppose was intended to follow after the English plan of pillar and stall work; but the work that was early done, even in some of our larger mines, is simply deplorable.

There are mines where many thousand dollars have been expended in the preparatory work of reaching the coal, and business-like principles and good judgment are exhibited in the work so far, but stops at the bottom of the shaft. This can be explained in two ways; there are two reasons for it. The proprietor of the business is seldom a miner, yet is a good, intelligent business man. He employs good mechanics to do his external work, men who are accustomed to their work, and understand their trade; but when he comes to the management of his underground work, he has to depend upon the ability and experience of some miner, and if there are forty around him, every one—taking his own word or story for it—has had extended experience in the management of mines in some old country, (hardly ever as near

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as Pennsylvania,) and understands the business perfectly—is a "practical miner," which simply means, nine times in ten, a man who knows how to handle a pick and drill moderately well, (but hates to terribly,) and knows but very little else about the subject of mining. I have often wondered what they did for miners in those old countries; it is about equal to the query what they did for private soldiers in the late war, they all being colonels and generals now.

The truth is, very few men who follow the mining business are capable of managing a coal mine on correct principles. A practical knowledge is a good and valuable commodity to have, but when it extends to only one, and that a small branch of the business, it falls short of the scope of knowledge and ability necessary for the man to possess to be practical in mining and all its details.

As I have said, there are two reasons for bad management in underground work: First, the incapacity or want of qualification of the mine superintendent. For want of capacity or ability, he is incapable of studying his business in a methodical and scientific manner, of working out and maturing plans, providing for unexpected difficulties and emergencies, handling air with a practical knowledge of its physical properties and laws which govern it, adopting the most perfect means of ventilation and drainage, and incapable of meeting and disposing of a hundred things incident to the business that are constantly arising for solution—incapable of securing with the means at hand the best results for both manager and miner.

What better management of underground work can be expected with mine superintendents of this character? Yet just such "practical miners" have had charge of mines, and some are in charge of mines now, and are looking for and expecting promotion.

The other reason for bad work underground is, that some operators care for nothing only to get the coal out as cheap as they possibly can—the most coal for the least money; will mine the nearest and cheapest coal, regardless of the future difficulties and expense; and before they are aware of it their mining is more expensive, and their difficulties well-nigh intolerable. Operators who lease mines can generally use a mine up in a very short time. They seem to think their interests consist in getting all the cheap coal, notwithstanding they may do the owner an irreparable damage. Every man who leases a coal mine should have a written agreement, in which all the details in the plan of mining should be recited, and heavy damages required in case of a departure from the written lease; no agreements or mutual understandings should be made outside of the written document.

Large amounts of coal have been lost, and some valuable coal is now being lost, from this way of mining.

It is not so bad as it was, and is getting better each year. When business men expend several thousand dollars in opening up and preparing to mine coal, they find that true economy consists in proper methods and correct

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plans; that it requires talent and education, at least a genuine practical education in coal mining; and that talent must be paid for, and that the very best talent is the cheapest, even at a high price.

Our managers are finding out that the very best qualified mine superintendents are the cheapest and best, and men filling these positions have learned that thorough knowledge and training are the requisites for obtaining and filling these places. Most of our large operators have this class of men, and many of less pretensions have very good men in these positions. Many have labored under great difficulties and many disadvantages from bad management before them, and have not had a fair trial of developing scientific and systematic mining, only in some new shafts recently opened.

In these new shafts they are starting out on correct plans; they are making their main roadways or entries double, carrying them along parallel, with a pillar of 12 to 16 feet between them, and making the necessary break-throughs to keep fresh air up to the work, and closing them behind them; at right angles from these main entries right and left they turn cross or butt entries, making break-throughs and closing them the same as in the main entries. These roadways are usually seven to eight feet wide; sometimes one of the cross entries is as wide or nearly so as a room; from these cross entries the rooms are turned, going a few feet narrow, and then widening out to twenty or twenty-four feet, the width the room is driven; the rooms being at right angles with the cross and parallel with the main entries. From these rooms is taken the body of coal mined. They are worked from forty to sixty yards, leaving a rib or pillar between six to ten feet thick or wide, for the support of the roof. There should be four rows of props in each room, sometimes more, as indicated by the roof. I have seen these rooms driven over 100 feet without a sign of a prop, but this should not be and is not allowed. Through the ribs air-ways are cut, following the same principle practiced in the entries. This is done about every sixty feet, to bring fresh air to the face where the men are at work. After the rooms are worked out, or before, other cross-entries are driven, and rooms turned and worked in the same way.

The tools used by the miner he purchases of the manager, and they consist of a drill, needle, scraper, from two to six mining picks, sledge, wedges, powder and oil cans. Usually two miners work in the same room; it is better that two should always work together; many things to do are inconvenient for one. Two can work together with a greater advantage; they are not so apt to overlook danger, and in case of accident one is always near to help, or give the alarm. The coal here is mined by what is called here "shooting." It is undermined, the undermining being done in the coal and about three feet in from face, and should be across the whole face of the room before shooting. The undermining is the hardest labor the miner has to do, and it requires tact and experience to do it skillfully. I know an English boy, seventeen years old, who does nicer and quicker work of this

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kind than some miners of twenty years' experience. After the undermining is completed, the drilling or boring is done for the powder forming the shot; the shooting or firing being done just before going out at noon and night, in order to give the powder-smoke time to escape before resuming work. Some miners make the powder do most of their work, undermining very little or none, and shooting from the solid face; this takes large quantities of powder—from three to even eight pounds of powder. It breaks the coal badly, making a great deal of fine coal and waste, and is an expensive and losing practice to miner and owner. After the coal is down, the miner loads the boxes, put on his number or check, pushes it to the entry, and here the pusher takes the loaded box and leaves an empty; the pusher's business is to run the coal to the shaft or nearest mule. After arriving at the top the coal passes over the screens, is weighed on the railroad car, and the weight placed to the credit of the number that comes up on the box. In most mines mules are used to haul the loaded boxes from near the work to the shaft, and the empties back. The track used in the entries is the light T iron rails, fifteen pounds to the yard; in the rooms, wooden rails are used.

In the Osage county district, at Leavenworth, and at the Lansing (Penitentiary) mine, the mining is done by the long-wall plan. The veins are light, and the coal is all mined after leaving the necessary pillars around the shaft; the work usually diverging in all directions from the shaft in the form of a circle. The undermining is done under the coal, and the coal brought down by hammer and wedge, no powder being required; it comes down in large pieces, with scarcely any fine coal or waste. Props are used at the face to support the roof during the mining; as the work proceeds, the goaf from the undermining is thrown back, and the roof gradually settles down on this waste material.

The rooms are usually forty feet wide, with two men in a room; the men have to keep their entries brushed down as they go along, to height of three feet; the sides of the entries are blocked up with the material brushed down. The ventilation of these mines is simple, and easily accomplished when managed right. The air passing down the shaft is carried through a main entry to the perimeter of the circle; here it splits, one-half going each way and passing around one-half of the circle; coming together at the opposite side, it takes the course to the air shaft.

In Osage county the shafts are numerous. The top-work or hoisting arrangements are simple and cheap, the coal being raised by horse-power. The top structure is simply a small and not high framework over the shaft, and an upright with lever and drum. There being no fine coal, the extensive arrangements for screens are unnecessary. The coal is weighed in the boxes, and passes through a small chute into the railway car. Generally with an expense of five to eight hundred dollars, the coal can be reached with top-work and hoisting apparatus complete.

The most coal is less than fifty feet deep, and is overlaid with a solid rock

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which renders the mines quite dry, some mines not making a barrel of water in a month. The water problem is a simple and inexpensive one.

AIR AND VENTILATION.

When I assumed the duties of this office, there was not a fan in use in the State; the furnace was the only mode of moving air through mines. There are now a number of fans in use, and very soon, where steam power is used, the furnace will be known no more forever. There is no question, where they are used, of their superiority over the furnace.

The ventilation of the mines in Kansas is perhaps as good as in any other State, but the ventilation of mines all over this country can be improved; that is to say, in every State are mines that at all times of the year are well and amply ventilated, while others are not. This has been demonstrated in the past year by evidence of the most terrible character. The awful loss of life, both west and east of us, undoubtedly could have been avoided by an increase of air-current at or near the time of accident. But with all this sad experience there comes some good from it. It has aroused and given impetus to the subject of mine ventilation, the result of which will be the improvement and advancement of this feature of mining.

Our situation in Kansas is about the same as in other States, with one considerable advantage, and that is, so far our mining has been free from the presence of explosive gases, although these do exist, to a slight degree, in the deep mines in Leavenworth county.

As a rule, the worst air we have is in those shafts of small operators where but little mining is done, and this at intervals in the year. This class think they cannot stand the expense of any important changes and improvements, but the expense is usually trifling, and I have found that the greatest difficulty is the want of knowledge on this subject; and when this lack of information is removed, if it can be removed, and your instruction made plain and simple to them, they do much better. Generally the large companies have the better air; they have the means, and do not feel the expense of providing for it. Through the cold months the air averages well and there is no complaint, but during the hot months if the arrangements are not good and everything in perfect order, the air will be stagnant and impure. In a number of our old works in the summer time it is almost impossible to maintain a constant current of air through the mine. But it is a happy relief to know this class of mines is getting less by being worked out and abandoned. I have made it a rule in all new work, where there has been a lack of knowledge, to start them right, and particularly in the direction of proper and ample ventilation; and at this stage of the work the expense is but little more to provide for an ample volume of air. With air-ways of the right size, with a properly constructed furnace, and careful attention to leakage or waste of air, and friction, but very few of our mines need to have any complaint from impure air. These principles I have attempted to inculcate and impress upon those whose duty it is to manage

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these matters. Although I prefer the fan, yet furnace ventilation can be made to answer for some time to come in many mines, with a capable mine overseer and a careful regard of the principles governing furnace ventilation.

That the advantages of the two plans may be better understood, I will here repeat part of an article written some time ago for the *Miners' Journal:*

"Of course whatever device is used, the quantity or volume of air should be abundant and ample for all the demands of men and animals, and if gases prevail, sufficient to carry them off as fast as they may issue or collect. There are two plans or methods now in general use in this country: the furnace and the fan. The furnace has been long in use, has been and is now a favorite in many localities, and much more used than the fan, not because it has any superior claims over the fan, for in many places and instances it is actually inferior to the fan, but is used because most anything a fire can be built on is made to answer the purpose. It is surprising to see in some mines the crude arrangements thrown together and called a furnace—a few old pieces of iron laid upon stones or brick, and a fire built on these irons. They are used simply because they can be thrown together in a few minutes, and cost mere nothing, and they amount to mere nothing as a means of ventilation.

"A properly constructed furnace in a deep mine will do as effective work as a fan, and answer the purpose of ventilation very well, but in shallow mines they are by no means as useful as the fan; and why are they not? What is the principle of furnace ventilation? In the first place, air, although we cannot see it, and it is entirely invisible to the most powerful eye, yet nothing is plainer to us than its existence; it is a tangible substance, can be handled, measured, weighed, compressed and expanded, thus possessing properties that are subject to the laws of physics. The pressure or weight of air on the surface of the earth for each square foot is about 2,100 pounds; that is, a column of air one foot square from the point above us as far as it may reach to the earth, weighs about 2,100 pounds. This weight varies some 200 pounds, owing to the difference in elevation and density of the air as indicated by the barometer, but the above is the average, and is generally used as the weight on the earth's surface. Thus we see air has weight, the same as water or any solid substance. Now, by the action of heat we can change the weight of air—we can make it much lighter, and as it becomes lighter than the surrounding air by the action of heat it rises up, and as it ascends the cold air, being heavier, rushes in to take its place; thus the air is put in motion, and a current is formed. Four hundred and fifty-nine cubic feet of air, at the earth's surface, weighs very nearly forty pounds. Now suppose we take this quantity of air, and heat it to the ordinary degree of heat in our furnace: it would then weigh not more than ten pounds, and thus only be one-fourth the weight of the common surrounding air. Of course, being so much lighter than the surrounding air, it would rise up rapidly, and the cold air rushing in to take its place would produce a strong current of air. Thus this simple principle of the action of heat on air is utilized in the ventilation of coal mines, but it is not as effectual and practical in shallow mines as deep mines; and let us see if we can make it intelligible why it is not.

"Suppose we have two mines of the same-sized openings, each provided with a properly constructed furnace, one fifty feet deep and one two hundred feet deep. In the fifty-feet shaft the air column would be the same height. Now, one square foot of air fifty feet high in the downcast, at a temperature of 62 degrees, would weigh 3.58 pounds; the same column in the upcast, at a temperature of 200 degrees, would weigh 2.90 pounds, a difference of just about three-fourths of a pound. This is the pressure or power to

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force one square-foot air column through the mine; but the difference is so small and light that it could exert but a weak influence in doing this. Now, take the other shaft, the temperature and everything being exactly the same, except the square-foot air column, being 200 feet high, would weigh 14.75 pounds; and in the upcast a similar column would weigh 11.62 pounds, giving a difference of a little over three pounds. Here we have three pounds weight or pressure behind each square-foot air column, to force or drive the air through the mine. This same force on the surface would drive the air twenty miles an hour, but in the mines friction would render it much less potent. From the above, in the shallow mine we have a propelling force of three-fourths of a pound, and in the deeper we have three pounds. Thus we can readily see that the deeper the mine the better results from the furnace. In addition to the above, in the upcast of the shallow mine, the rapidity of the light air would scarcely get started or under way before reaching the surface, and then it would become lost and dissipated. In the deeper mine the hot air in the upcast, having a greater pressure behind it, and having further to travel, it would gain in velocity, causing a stronger current to rush in behind to fill its place. This same principle is practiced in all our mills and manufacturing institutions, where we see the tall smoke-stacks. These stacks run up sometimes one hundred feet, when a great and powerful draft is required.

"The prevailing opinion now among the most experienced miners is in favor of the fan in shallow mines. It has many advantages. It gives more air; it can be increased or decreased to suit any condition of the mine; it can be reversed in cold weather, preventing freezing and all its attendant evils; it is cheaper than the furnace in the long run; it is no trouble to run the fan; and it is attended with no extra cost where steam is used.

"Before closing this communication, I wish to briefly mention the proper construction of furnaces, without going into the details of double walls filled with sand, or left open, with air spaces for air to circulate through in order to prevent the great heat from communicating with adjoining combustible material. The furnace should be built of fire-clay brick; should be at least six feet wide, and same length, with back-end raised four inches. From the grates to the center of the arch above, it should be from three and one-half feet to four feet high — not over four feet; for if you get the opening too high, much air will go over without being heated. I believe the object of a furnace is to heat and rarify the air. This is what it is for. Therefore, I cannot agree with those who advocate high furnaces, and also openings at the sides, for cold air to pass back and counteract the very object and principle of the furnace. I believe the furnace should be amply wide for all the air that can circulate through the air-ways of the mine to pass through the furnace, and over the fire. I believe these advocates of openings at the side of the furnace get their good results simply from the fact that the furnaces are not capacious enough to allow all the air to go through them. Of course when the air comes to the furnace, and becomes blocked for want of space to pass through it, then openings will give this residual air a chance to pass back and increase the current. The furnace should be placed back thirty or forty feet from upcast, and the opening from furnace to upcast should be one-fourth larger than capacity of furnace, and should rise two feet in every ten feet of distance."

In addition to the foregoing on ventilation, I copy the following from Andrew Roy, recently Inspector of Mines for the State of Ohio, who stands as high as any gentleman in this country on mine subjects:

"In mines in which no fire-damp is given off, fully 100 cubic feet of air per miner per minute should be circulated in the mine; in mines which make fire-damp a much greater quantity is required, particularly if the fire-damp is emitted copiously. But this current must be made to sweep through the interior of the mine, where the men are

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employed, or it will do little or no good. There may be ten times the amount of air required for the sanitary condition of a mine entering by the intake and being discharged by the upcast, and yet the working-places in the interior be in a very defective condition. Under every system of ventilation there is a loss of air by leakage through the trap-doors. When two separate openings of different depths are made into a mine, a current of air is set in motion by the natural pressure of the atmosphere. In winter the lower opening will be the downcast, and in summer it will be the upcast, because during winter the atmosphere outside is denser, and consequently heavier, than the air of the mine, while in summer the reverse is the case. During those seasons of the year in which the mine atmosphere and the air outside approximate each other in density, there will be no motion, or it will be so slight as to be of little service for ventilation.

"As underground excavations become more extensive, the natural forces, even during seasons most favorable to their operation, become wholly inadequate as a ventilating power, owing to the resistance which the top, bottom and sides of the air-ways offer to the moving current of air, and artificial ventilation has to be applied to produce a circulation of sufficient power to sweep away the gases and render them harmless. Furnaces and fans are the favorite powers applied to produce artificial ventilation. Frequently exhaust steam from the steam pump at the bottom of the upcast or pumping shaft is applied; but while this is a valuable auxiliary, it is too weak a ventilating force in a large and extensive mine to be used alone if systematic perfection in ventilation be desired.

"The furnace has long been the favorite method of producing ventilation among practical men, but of late years exhaust-fans of the Guibal, Waddle, Schiele and other patterns have been introduced, and have worked so successfully as to supplant the furnace nearly altogether over large and important mining districts in England and the continental states of Europe. The furnace in its first cost is cheaper than the fan, and in deep mines is capable of doing equally effective work, while for shallow shaft mines the fan is both cheaper and more effective as a ventilating power. The furnace is likely, however, to continue as a ventilator as long as coal-mining is followed either in this or other countries. The proper construction of a ventilating furnace is a debatable question among mining engineers. A thin, wide fire and low arch, in my judgment, should never be higher than three and one-half feet above the bars, and the wider the furnace is the better, and the whole width should be kept constantly and uniformly heated. As furnaces are ordinarily built they do not admit the whole amount of air which they are capable of moving, hence it is found to add to their ventilating power to provide side chambers. The object of these chambers is to admit the passage of columns of cool air between the furnace and pillars of coal for the purpose of preventing the pillars taking fire; but the chambers are found in practice to add to the amount of current. This fact produced quite a discussion among some of the members of the Ohio Institute of Mining Engineers, at the Nelsonville meeting in May, 1882. The Orbiston mine, which is opened on the thick coal of the Hocking valley, was visited by several of the members of this society. The air courses are 8 feet wide and 8 feet high, making a sectional arch of 64 feet. The furnace is 6 feet wide, 3½ feet high above the bars, and has two side chambers for the passage of cool air. Mr. Palmer, the mining boss, stated that when these chambers were opened the amount of current was increased fully 2,000 feet per minute, the column of air moved being about 30,000 cubic feet per minute. Mr. Hazeltine contended that there must have been a mistake committed in taking the measurements, as the cool air which passed through the side chambers would, by mixing with the hot air which passed through the furnace, decrease the temperature in the upcast shaft, and so reduce rather than increase the amount of air in circulation.

"I have taken measurements frequently in mines where the current was increased in quantity where side chambers were opened, and while Mr. Hazeltine was undoubtedly

correct in theory, his idea did not embrace the whole theory. The greater the heat communicated to the air of the upcast, the greater must of course be the ventilating pressure. The power was lost in the passage of air through the furnace, for the sectional area of the furnace was only eleven or twelve feet, being fully five times smaller than the airway of the mine, while the column of air itself became expanded to more than double its volume in passing over the fire. The resistance which the air encountered at the furnace checked the column, which found vent when the side chambers were opened; hence the increase in the quantity of air. The cool air which escaped through the side chambers would, on uniting with the hot column which passed over the fire, decrease the temperature to some extent and so lessen the ventilating pressure, as Mr. Hazeltine suggested; but this counterpoising influence was overcome to the extent of an increase of 2,000 cubic feet by the side chambers of the furnace. Some years ago the furnace attendant in a mine in the Mahoning valley, in digging coal for the furnace near the bottom of the upcast shaft, accidentally cut into the shaft. As soon as the coal was removed, the flow of air increased 60 per cent. The mine boss was astonished and delighted, and when I visited the mine afterward he told me that he had made an important discovery in mining ventilation and proposed applying for a patent on it. I told him his furnace was too small for the requirements of the mine, that the air had not room to pass through the furnace, and his plan was, not to apply for a patent, but to pull down his furnace and treble its sectional area, and he would behold still more surprising results in the increase of current.

"Where the airways of a mine are of, say thirty feet of a sectional area, a furnace seven feet wide and three and one-half feet high above the bars, will, I think, approach systematic perfection. The furnace has a limit to its power, and when it is reached we pile on coals in vain. In building a furnace it adds to its efficiency to slant it upward inside of the bars, say one foot in six until the upcast shaft is reached.

"In the mines of this State, the quantity of air moved by a properly constructed furnace ranges from 2,000 to 6,000 cubic feet per minute for every foot of breadth of fire. The depth of the ventilating shaft, its freedom from water, the size of the air-courses of the mine, the temperature of the outside atmosphere, all combine in determining the quantity of air which can be moved through a mine by furnace ventilation. In winter, as already stated, the natural forces aid the ventilation, while in summer the natural forces oppose the furnace, like a steamboat going up stream. In deep mines, like those in England, the natural current is in the direction of the upcast all the year round, because the mine air of deep mines is always rarer than the atmosphere on the surface; but while in summer there is no opposing force to overcome, there is little assistance given, the temperature of mine and surface air being so nearly equal in weight. In winter the natural forces and the furnace in proportion to the difference of temperature of the mine and surface air. The practical power of the furnace is in proportion to the depth of the shaft, the power being as the ratio of the depth; hence a shaft 400 feet deep will with the same furnace, all other things being equal, move double the quantity of air as a shaft 100 feet deep. This practical fact is not as well understood as it should be, the common impression being that shallow mines move more air than deep ones with the same ventilative power. Until within a few years ago, it was a rare thing to see a roomy, well-constructed furnace in a coal mine in this State, owing to this mistaken view of the influence of heated air in shafts.

"Fan ventilation, on the other hand, is more effective in shallow than deep mines, but fan ventilation has only recently been applied in this State, and is not making as rapid headway as could be wished, mainly from the fact that the first cost of the fan is considerably greater than that of the furnace, and in drift mines it is as costly at all times, because at drift mines the fan and engine require the attendance of an engineer, while

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in a shaft mine the hoisting engineer can attend both engines, which is a saving of one man at the mine, besides the saving in the coal required to maintain a ventilating furnace. Whenever furnace ventilation is applied, the supply of air is liable to great irregularity by neglect of the furnace man; and the danger of fire, of which we have so many fatal examples, is ever present. Moreover, in mines where the furnace is placed at the bottom of the hoisting shaft, the guides, the ropes, and the timber of the shaft are subject to injury from the gases given off by the furnace. All these evils are obviated by the fan, in addition to the daily saving in fuel and attendance.

"The best ventilating fans are constructed on the centrifugallar principle, and those of the Waddle, Schiele, and Guibal patterns, as already stated, have attained high fame in England and the continental states of Europe. Guibal's is preferred to the others, and is probably the best ventilating fan for the use of coal mines ever applied in any country. This fan has a large diameter, some of those used at the deep and extensive mines in England ranging from forty to fifty feet. The blades of the fan, eight in number and ten feet wide, are inclined backward, and the air is discharged through an adjustable shutter into an expanding chimney, about twenty feet in height. This fan, although more extensively applied in the coal-mining districts of England and Continental Europe than all other fans combined, is yet mainly confined in this country to the anthracite region of Pennsylvania, because such costly and elaborate arrangements as attend its construction are not required to produce the limited currents of air which suffice for our shallower and smaller mines. From 250,000 to 300,000 cubic feet of air per minute are frequently produced by means of the largest Guibal fans in the mines of England.

"The Champion fan, which was introduced into the mining regions of Ohio and other Western States a few years ago, gives very satisfactory results. Wherever this fan has been introduced mining engineers and mining bosses declare that they could not be hired to go back to the furnace as a ventilating power. This fan consists of two revolving wheels set in one shaft, a few feet apart; the blades are so constructed that they do not oppose any flat resistance to the air, being curved backward and run into the circumference. There are several sizes made, which range from 4 to 10 feet in diameter; the speed of the fan is from 200 to 600 revolutions per minute, and from 10,000 to 60,000 cubic feet of air per minute is put in motion throughout the mine, according to the size of the fan, the speed at which it is run, and the frictional resistance which the air encounters in traversing the galleries of the mine. The air is received between the wheels of the fan and is expelled direct to open day, and the machine is so constructed that it can be used either as an exhaust or blowing fan without changing the gearing or stopping the engine. This advantage will be duly appreciated by mining bosses who are plagued with wet shafts which freeze in winter.

"All of the fans mentioned in this paper are operated on the exhaust principle, which is found in practice to be much more effective than blowing air through a mine. Blowing fans are, however, occasionally used, and there are two of this kind in the Mahoning valley, one at the Church Hill shaft, in Trumbull county, and the other at the Leadville shaft, in Mahoning county. The diameter of these fans is about 7 feet, the width of the blade being 3 feet. They move each from 14,000 to 16,000 cubic feet of air per minute, and serve every purpose for which they were intended."

NUMBER OF SHAFTS.

In Osage county there are ninety-one shafts, of which thirteen are abandoned, ten idle, the remainder in operation, but some working less than one-half dozen men, located as follows:

Osage City and vicinity	34
Peterton	5

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Dragoon	3
Burlingame	12
Scranton	19
Carbondale	18

In Cherokee county twenty-four shafts—three abandoned, the others in operation; ten are operated by steam power. They are located at the following points:

North of Columbus	4
New Castle	2
Stilson	2
Scammonville	5
Weir City and vicinity	11

In Crawford county thirteen shafts—two abandoned, and one at Cherokee not worked; seven are operated by steam, and all located at Pittsburg and Litchfield.

At Omio, Jewell county, a new shaft is just starting, operated by steam power.

In the number of shafts given above, there are a few slopes, (not over one-half dozen,) not enough to make any distinction.

In Franklin, Neosho, Anderson, Bourbon, Linn, Cloud, Jewell, Ellsworth, Russell, Lincoln and Mitchell counties, there are about 180 shafts, slopes, and drifts, ninety per cent. of which are worked to some extent this time of year (winter). There are some other counties that work thin veins a few months of the year, but I have not sufficient knowledge of the details to make any definite report.

In Shawnee county, a short distance from Topeka (west), are a few shafts. In Linn county, at La Cygne, are two shafts, and another a short distance east; they work a few months in the year.

I wish that every person in the State who mines not even over fifty bushels of coal in the year, would send me a report of the amount mined.

It is impossible for the Inspector to visit all these small places, and get this information; and it is a small matter for the man who does the mining to send a postal card, once a month, with statement of amount of coal mined. I have postal cards already prepared for these reports, that I shall be glad to send to anyone who will request it. Make the statement on card, and mail to me.

THE OUTPUT OF COAL FOR 1884.

The year 1884 in the coal mines of Kansas has been more than usually active. The first part of the year was dull, but the business revived early, and has continued active throughout the year. This would hardly be expected, considering the great depression in the business of the whole country; and were it not for the strike among the Colorado miners, our mines would have felt the depressing influences now pervading every department of business. In all the districts where coal is mined for transportation, the work has been nearly full time, even in the dull warm months. As the result of

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this prosperous year, Kansas has produced probably 200,000 tons more coal than in any one year before. Although there is a large increase in the output every year, from the increasing demand of new territory being opened, and increase in population, disappearance of other forms of fuel and increase in easy circumstances of the people. All these circumstances must improve each year in the future, for a long time yet, making coal mining an important and growing industry in our State.

In the output this year I have attempted to keep as near a correct account as possible. In all the larger districts my means for correct information are very good. But every year there is a large amount of coal mined that the Inspector has no means of obtaining. There is hardly a county in the eastern half of the State, but during the winter and cold months small veins are worked for neighborhood demands. The aggregate output of this kind of coal must be large. The mining is done by farmers and laborers chiefly, during the idle time of the cold months. In my statement of coal mined, I have estimated this kind of coal at about 43,000 tons. I have estimated it at this amount because I believe there is fully this amount, and very likely it is not as large as the actual amount, could it be accurately obtained; this estimate brings the whole output in the State to 1,100,000 tons or 27,500,000 bushels. In the statement of coal mined I have given it monthly as reported to me by the operator.

In crediting the amounts as mined at certain places, I have selected the towns or places where the larger amounts are mined, and grouped with them all the smaller mines around them. For instance, Scammonville includes all the mines on main line of Gulf Railroad, such as are at north of Columbus, Newcastle, Stilson, and all the mines nearer these places than any other place in list; Scammonville is a sort of center of all these mines. Pittsburg includes all mines at Pittsburg; also those at Litchfield, and those at Lone Elm or Lone Oak, or whatever they call the place north of Pittsburg; in fact, it includes all mines in Crawford county. Osage City includes all mines east, west and south of it; also at Peterton and Dragoon. The other towns the same way—all mines nearer to them than to other places. Leavenworth county includes shaft at Leavenworth and at the Penitentiary. Franklin and other counties include Franklin, Neosho, Ellsworth, Russell, Lincoln, Cloud, Linn, and Bourbon.

This same plan also obtains in the statement of miners, showing number of miners and other employés each month. This statement does not include operators, superintendents, clerks, or other employés in similar positions.

The stripped coal credited to Osage and Franklin counties was all stripped in Osage county, near Scranton and Carbondale, except about 60,000 bushels from the latter county. The other stripped coal is from Crawford county. This amount of coal will give employment to 160 men and 80 teams for eight months in the year, at good fair wages. A large share of this work is done by farmers, and the people who live in the neighborhood of the work, and is a valuable pecuniary help to them.

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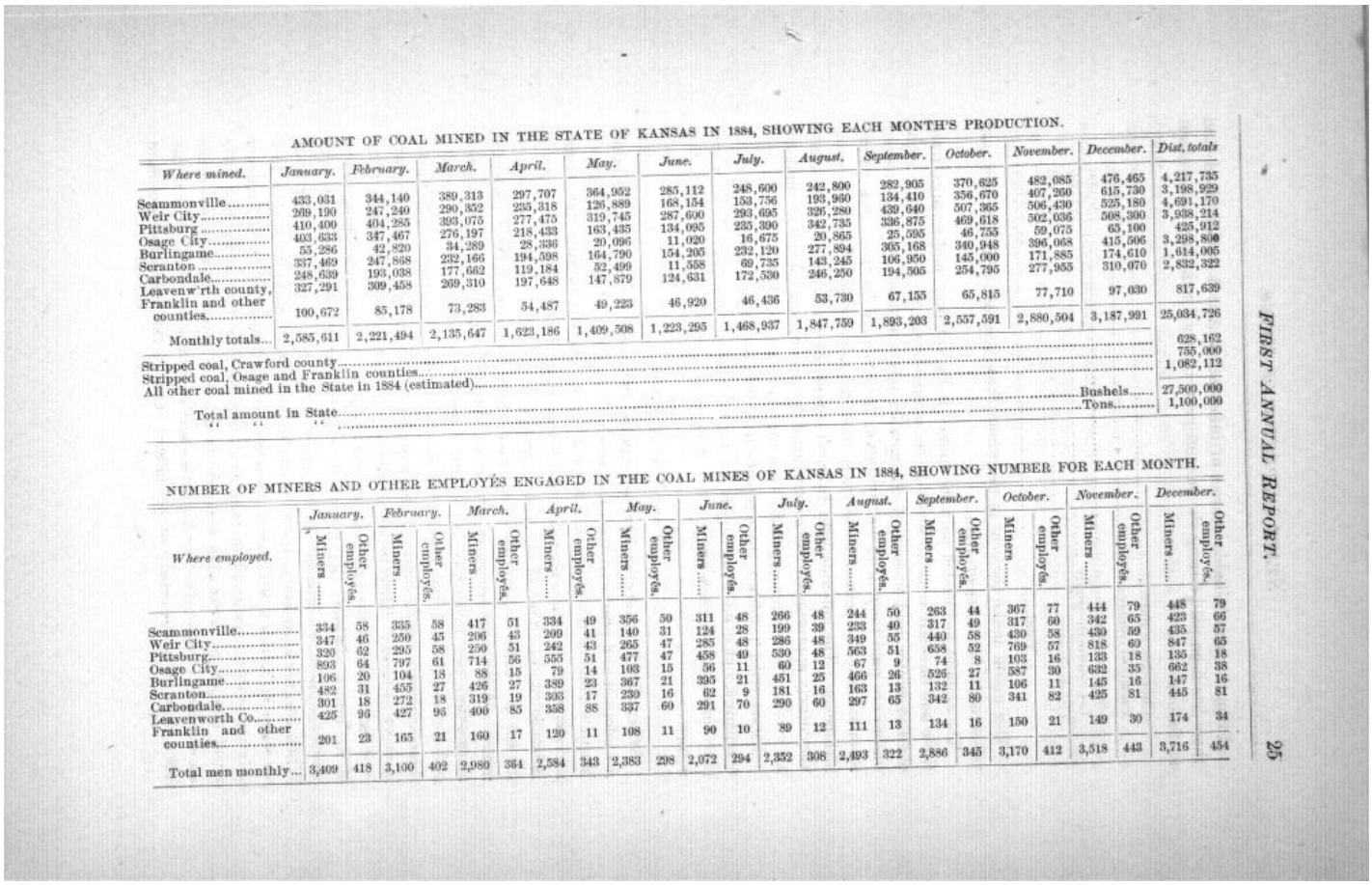

AMOUNT OF COAL MINED IN THE STATE OF KANSAS IN 1884, SHOWING EACH MONTH'S PRODUCTION.

Where mined.	*January.*	*February.*	*March.*	*April.*	*May.*	*June.*	*July.*	*August.*	*September.*	*October.*	*November.*	*December.*	*Dist. totals*
Scammonville	433,031	344,140	389,313	297,707	364,952	285,112	248,600	242,800	282,905	370,625	482,085	476,465	4,217,735
Weir City	269,190	247,240	290,352	235,318	126,889	168,154	153,756	193,960	134,410	356,670	407,260	615,730	3,198,929
Pittsburg	410,400	404,285	393,075	277,475	319,745	287,600	293,695	326,280	439,640	507,365	506,430	525,180	4,691,170
Osage City	403,633	347,467	276,197	218,433	163,435	134,095	235,390	342,735	336,875	469,618	502,036	508,300	3,938,214
Burlingame	55,286	42,820	34,289	28,336	20,096	11,020	16,675	20,865	25,595	46,755	59,075	65,100	425,912
Scranton	337,469	247,868	232,165	194,598	164,790	154,205	232,120	277,894	305,168	340,948	396,068	415,506	3,298,800
Carbondale	248,639	193,038	177,582	119,184	52,499	11,558	69,735	143,245	106,950	145,000	171,885	174,610	1,614,005
Leavenworth county, Franklin and other counties	327,291	309,458	269,310	197,648	147,879	124,631	172,530	246,250	194,505	254,795	277,955	310,070	2,832,322
	100,672	85,178	73,283	54,487	49,223	46,920	46,436	53,730	67,155	65,815	77,710	97,030	817,639
Monthly totals	2,585,611	2,221,494	2,135,647	1,623,186	1,409,508	1,223,295	1,468,937	1,847,759	1,893,203	2,557,591	2,880,504	3,187,991	25,034,726
Stripped coal, Crawford county													628,162
Stripped coal, Osage and Franklin counties													755,000
All other coal mined in the State in 1884 (estimated)													1,082,112
Total amount in State												Bushels	27,500,000
" " "												Tons	1,100,000

NUMBER OF MINERS AND OTHER EMPLOYÉS ENGAGED IN THE COAL MINES OF KANSAS IN 1884, SHOWING NUMBER FOR EACH MONTH.

Where employed.	*January.*		*February.*		*March.*		*April.*		*May.*		*June.*		*July.*		*August.*		*September.*		*October.*		*November.*		*December.*	
	Miners	Other employés.	Miners	Other employés.	Miners	Other employés.	Miners	Other employés.	Miners	Other employés.	Miners	Other employés.	Miners	Other employés.	Miners	Other employés.	Miners	Other employés.	Miners	Other employés.	Miners	Other employés.	Miners	Other employés.
Scammonville	334	58	335	58	417	51	334	49	356	50	311	48	266	48	244	50	263	44	367	77	444	79	448	79
Weir City	347	46	250	45	206	43	209	41	140	31	124	28	199	39	233	40	317	49	317	60	342	65	423	66
Pittsburg	320	62	295	58	250	51	242	43	265	47	285	48	286	48	349	55	440	58	430	58	430	59	435	57
Osage City	893	64	707	61	714	56	555	51	477	47	458	49	530	48	563	51	658	52	769	57	818	60	847	65
Burlingame	106	20	104	18	88	15	79	14	103	15	56	11	60	12	67	9	74	8	103	16	133	18	135	18
Scranton	482	31	455	27	426	27	389	23	367	21	395	21	451	25	466	26	526	27	587	30	632	35	662	38
Carbondale	301	18	272	18	319	19	303	17	230	16	62	9	181	16	163	13	132	11	106	11	145	16	147	16
Leavenworth Co.	425	96	427	96	400	85	358	88	337	60	291	70	290	60	297	65	342	80	341	82	425	81	445	81
Franklin and other counties	201	23	165	21	160	17	120	11	108	11	90	10	89	12	111	13	134	16	150	21	149	30	174	34
Total men monthly	3,409	418	3,100	402	2,980	364	2,584	343	2,383	298	2,072	294	2,352	308	2,493	322	2,886	345	3,170	412	3,518	443	3,716	454

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From the most reliable sources of information that I can obtain, I find there has been paid during the current year, money for mining alone about as follows:

Cherokee county	$290,000
Crawford county	240,000
Osage county	750,000
Leavenworth county	175,000
Other places	100,000
Total	$1,555,000

This would make the coal in the whole State average $1.55 per ton, cost price ready for transportation.

The amount per bushel paid the miners in the different mines varies from three and one-half cents to seven in the summer time, to from four to eight cents in winter, and in some of the smaller mines as high as nine cents per bushel are paid the miner; but averaging the prices in the State, and taking amounts actually paid out, the price paid the miner would be six and one-fifth cents. The amounts paid railroad companies for transportation would very nearly approximate the amount paid the miner, or $1,555,000; making the coal in the State cost the dealer a little over $3,000,000.

I have tried to obtain the proportion of the coal consumed by railroad companies, but it has been impossible for me to get only a part of the necessary information; therefore I have thought it best to dispense with this subject.

FATAL ACCIDENTS.

When all the protection and safeguards known in the science of mining are adopted and practiced, then the pursuit is one fraught with great danger. Happily none of the mines in Kansas are more than ordinarily dangerous, and some are to some extent less dangerous than the average of coal mines in other States. One of the most common causes of accidents is what is known as "falls"—portions of the roof scaling off and falling upon the miner. While this occurs in our mines, yet we have what may be termed an excellent roof in most of our mining districts; and with careful attention and close observance by the miner of the rules ordinarily practiced in mines, these accidents can be detected and avoided to a degree of almost certainty in every instance. These accidents should seldom if ever occur in this State. Accidents occur in the great majority of cases in the room or working-places of the mines. Miners like everybody will get careless, some of them very careless, almost to a criminal degree, endangering their own and other lives. When a miner is so lost to his duties to his fellow-man as to fire a shot in a rib when he knows it will break through into the adjoining room, and not only not give the occupant of that room warning, but fails to see that he is out of danger, then the man who will do an act of this kind becomes in the law criminally responsible for his action and should be made to suffer to the full extent of the enormity of his crime. One of the important duties of

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the Inspector I believe is to constantly warn the miner of danger; and it is the duty of all mine superintendents to do the same. The miner should never be permitted, if possible to avoid, to get into a state of carelessness and indifference.

Rules (printed) should be posted at every mine, making it obligatory upon every miner to carefully examine his room or working-place every morning and every noon before he attempts to do a stroke of work. This simple precaution would have saved a valuable life last year in one of our mines. The room is the property of the miner: it is his duty and his duty alone to carefully watch and guard every portion of it; and never delay for one single moment that which could in any possible manner endanger life or limb.

One-half of all the lives lost in coal mines are from neglect and carelessness; there is no use in denying this; it is a lamentable fact that cannot be controverted. Therefore I say to the miner, mining is always a dangerous pursuit; keep this constantly in mind; never allow yourself to become careless; watch—always be on guard; and always be willing to listen to warning; it will do you no harm, and it may save your life.

In the year 1884 there have been three fatal accidents—three lives lost in the State—which, considering all the circumstances, must be considered very favorable. There have been seven other accidents, none that are permanently serious, and only two where bones have been broken, and would be considered serious at the time of the accident. I have made no permanent record of these accidents, as I have been informed that all have made good recoveries, and resumed work.

On the 29th of January, 1884, at No. 3 shaft, Keith & Perry Coal Co., Scammonville, Cherokee county, Matthew McMahon received an injury from which he died on the third day after. He was in his room, and in the act of loading a box. As he was putting a lump of coal in the box, a small scale of slate fell, and knocked his head against the edge of the box, probably fracturing his skull. The piece that fell was not large and heavy enough to have done him serious injury, had it not caught his head on the sharp edge of the box. He was not a miner; had been in the British Navy from boyhood; deserted six weeks before, at San Francisco, Cal.; was 28 years of age, unmarried, and born in County Clare, Ireland.

On March 2, at Newcastle, Cherokee county, at the shaft of the Cherokee Brilliant Coal Company, Dugan Jasper was killed by falling into the shaft. He was employed on the top landing caging, had gone to the ground landing to put on some rails or props, and as the cage descended that he had loaded, he stepped to the other side, and attempted to step on the ascending cage to go to the top landing. He missed his step, fell under the cage into the shaft and was instantly killed. He was 20 years old, single, and his folks live in Greenwood county, Kentucky.

On the 4th day of April, at Litchfield, Crawford county, No. 5 shaft of

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the Rogers Coal Company, Franz Baucher was injured, and died forty hours afterward. He and his partner worked in an entry. They fired all shots in this shaft just before going out at noon and night. Baucher and partner were in the habit, when firing, to go into the first room for safety. As usual on this day, after getting their noon shot ready, they lighted it and went into the same room, but a man had been put to work in the adjoining room unknown to them, and had lit his shot and gone; as they stepped into the room the shot in the adjoining room exploded, broke through into the room in which they had gone, injuring Baucher fatally. He was thirty-three years old, unmarried, and an Austrian by birth. Had always followed mining.

The percentage of lives lost in coal mines is obtained by averaging the number of tons produced for each life lost. For instance, three lives have been lost in Kansas:

Year.	*No. fatal accidents.*	*Tons mined.*	*No. of tons per each fatal accident.*
1884	3	1,100 000	366,666

I am very certain this is the most favorable showing that any State in the Union can produce. In Ohio, in 1883, there was a life lost for every 316,346 tons mined, and this under a very stringent mining law of some ten years' standing, and an Inspector of superior attainments. Mr. Roy, the Inspector, thinks it doubtful if the number of fatal accidents to amount of coal mined will be much reduced from these figures. But we expect in Kansas to make a considerable better showing.

In 1883, in Pennsylvania, there was one life lost for every 214,928 tons of coal mined. In Illinois, same year, one life lost for every 78,424 tons raised. In Great Britain, one life lost for every 198,119 tons of coal produced.

In Illinois the ratio of coal produced to lives lost is shockingly small, owing principally to the frightful accident at the Diamond Mine in Will county, where seventy lives were lost by water breaking through and flooding the mine.

COAL COMPANIES AND OPERATORS.

THE COLUMBUS COAL COMPANY.—Headquarters, Columbus, Cherokee county; T. P. Anderson, president; T. J. Wilson, superintendent; ——— Edwards, mine boss. Located on Kansas City, Fort Scott & Gulf Railroad, four miles north of Columbus; one shaft; steam power; has escapement shaft with ladders; has been in operation two years; vein, four feet; mined by pillar-and-stall plan; works about thirty men; trade mostly south over Gulf Railroad, and west over 'Frisco Railroad. This shaft is managed very well, and underground work in very good shape.

CHEROKEE BRILLIANT COAL AND MINING COMPANY.—Located at New Castle, Cherokee county; A. Chadwick, president; J. W. Marstellar, super-

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intendent; ——— Woodson, mine boss. One shaft on Kansas City, Fort Scott & Gulf Railroad, six miles north of Columbus; has several air and escapement shafts; has been in operation about eighteen months. All the work about this shaft is very elaborate; every convenience even to detail has been provided; the engine is double, has two 24-feet boilers; shaft large and capacious; hoisting structure strong and permanent; in fact everything around these works has been done with a generous hand. Very nearly 100 miners and laborers are employed; the business is over the Gulf Railroad, north principally; vein about four feet thick; underground work in fair condition.

THE ALLEN SHAFT, at Stilson, Cherokee county, on the Gulf Railroad, owned by Gilbert Allen but now leased by East & Coleman; steam power; has air shaft. This is one of the oldest shafts in this district, but the owner has always leased, and it has been very badly managed; has never done but a light business; probably a dozen different leases have been made, no one keeping it only a short time; the underground work has been miserably managed; some of the worst butchering done in this work was by men who make loud pretension as being practical miners, and who, if they knew better, had not the honesty to manage the mine properly; under the present management the shaft is doing much better and as well probably as can be done with the situation they have to deal with. They are working about thirty men, the trade is over the Gulf Railroad, north and south.

THE KEITH & PERRY COAL COMPANY is located at Scammonville, Cherokee county. This is an incorporated company, with headquarters and main office on Delaware street, Kansas City. Messrs. Keith and Perry both are pioneer men in the coal business of Kansas. They commenced in a small way many years ago, and with an energy and pluck few men possess have met and overcome many trying emergencies incident to the business in its early days. This company, with their large business in Missouri, probably do more business than any other firm in the West. They own two large shafts and several hundred acres of coal land; besides, they lease a shaft — making three large steam shafts that they are operating. The shafts are near the main line of the Kansas City, Ft. Scott & Gulf Railroad, having switches to them. These shafts all have first-class steam machinery; large and capacious hoisting apparatus, and all the conveniences necessary in first-class mining. David Mackey is the superintendent, having all the works under his management; he is a practical miner in its full sense, always gentlemanly and accommodating in all the arduous duties he has to perform. These shafts are all provided with second openings. The vein is the ordinary four-foot vein in this locality. Nearly three hundred men are employed in and around this company's works; the output is large, reaching from thirty to forty car-loads daily, of from 400 to 500 bushels each; their shipments are over the Gulf Railroad north. The company have a large store, in which they carry a large stock of general merchandise and miners' outfits.

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THE GALENA COAL AND MINING COMPANY.—The shaft of this is located at Scammonville, on the Gulf Railroad. W. C. Norton is the superintendent and manager; it is a new shaft, only operated a short time; they use the gin arrangement, and horse-power for raising. The company are doing yet only a small business, working ten men, and shipping south over the Gulf Railroad.

THE OSWEGO COAL AND MINING COMPANY.—This company has its principal offices in Springfield, Mo.; B. F. Hobart, president, and A. Douglass, secretary. The mines are located at Weir City, Cherokee county, on the branch of the Gulf Railroad from Cherryvale to Arcadia. This company has five shafts under its management. The old No. 1 shaft has been worked out and abandoned, but a new one has been put down in its place. No. 5 shaft was sunk and fitted a little over a year ago (in the summer of 1883). This is the only one of the kind in the State. Heavy, strong and most approved machinery was put in; having four boilers, and in addition an air compressor, machinery and connections for using the Harrison mining machine. These machines were used during last season, but not with perfect success, as the underground work was considerably faulty, which operated against the proper and successful use of the machines; being crowded for coal, they withdrew the machines, and have not made further attempt. The company intend to use them again and give them another trial under more favorable circumstances. There is no doubt in the hands of experienced and skillful operators, these machines will prove a success in this vein of coal. Mr. John R. Braidwood is the mine superintendent of this company, also of the Rogers company. He has all the mines of this company and all the mines of the Rogers company under his supervision. He is a gentleman of superior attainments in his business, eminently practical and progressive; he has had transmitted to him from an ancestry of miners, a peculiar tact and skill, united with great energy and pride in his profession; he is of a class that never fail, because of a thorough foundation of practical knowledge in every detail of his profession. I feel to some degree obligated to Mr. Braidwood for the interest he has taken in ventilation of mines, and always ready and willing to do anything that would act as an improvement in this matter. It was he who put into practical operation the first fan in the State for ventilation of mines. This pioneer fan is in this No. 5 shaft, and works to a perfection. It has demonstrated the superiority of the fan over the furnace in shallow mines. The volume of air can be increased or decreased at the pleasure of the superintendent and demand of the men below; in summer time a stronger current and greater volume is needed, to overcome the natural inertia that exists from a similar temperature of the air existing above and below the surface; in winter the opposite conditions exist, the warmer air of the mines naturally arising and the colder air falling in after it, causing a considerable current; but I have already made my argument in favor of the fan, and will not renew or ex-